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ABSTRACT

This paper examines the kinds of persons that engineering education produces, focusing on cultural identities related to gender issues. It is based on survey questionnaires, interviews, and observations of 274 first-year and fourth-year engineering students at a state university known for its concern about the education of women engineers. The study found numerous instances of engineering being conceived of by students as a male profession, with women marginalized for not appearing to conform to the culture of the profession. Three cultural-identity categories emerged in the cultural model underpinning student engineers' talk at the university: Greeks, academic achievers, and nerds. Within these categories, few terms could be applied to female students in a positive light, and female students were often thought of by many male students in pejorative terms. The paper goes on to describe the interactions of male and female students in small-group activities, and provides examples of sexist attitudes and behaviors among male students. It argues that the status hierarchy among engineering students has led to the near-invisibility of women within the engineering community. (Contains 35 references.) (MDM)

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ENGINEERING GENDER - GENDERING ENGINEERING: WHAT ABOUT WOMEN IN NERD-DOM?

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Researcher (female): *What words do you and your friends use to refer to other student engineers?*

Men Student Engineers: *Just like any engineering school. You'd have the nerds, the geeks, the person who breaks the curve, the one who sits in the corner of the classroom up front, answering all the questions (A-4), squids - the nerds of the nerds....You know; we're basically all nerds here (A-12).*

Researcher: *Do these terms include women?*

Men Student Engineers: *When I think of them [the identity terms], I think of guys more, just because there's more guys here I can associate names with. But I don't know, a lot of the girls, I can't really think of a name (A-6)....[When I think of] the nerd-type profile - the pocket-protector-nerd kind of guys, you don't think of women as that, I guess. At least at this school, I think guys here so much appreciate that a girl chose to come to this campus that you're just like "Great!," you know. There's so many guys that you can say this guy's a nerd, the pocket-protector-wearing guy (A-16).*

Researcher: *Are there terms that refer only to women?*

Men Student Engineer: *Well, first of all you think, how many girls go into engineering? How many of them can come to Public Engineering School [PES]? And then, how many of them are pretty? You're down to about 2. [Women students] come here as freshmen. And in high school, they might have just been average or cute, but they come here and compared to everybody else, all the other girls, either drop out or have a boyfriend or are just nothing to look at. They come here and immediately they get all this attention [from men students] and everybody's wanting to take them out....[Going out] becomes so fun that they don't do homework. They find other things to do. Sooner or later, they're gone after a semester, after a year. It's back to the same situation, the next girl that comes through is going to [do those same things] and the girls that stay get labeled. [They are called] PES-woman and everyone thinks a PES-woman is big, ugly, easy. Sluts. Whatever. Just because they have to have gone out with so many people or, I don't know, just that they're nothing. They get labeled that way and you spend four years going through a school, usually five years, with that label - just because you're a girl and you go through PES. There are some girls here who really have their act together and they're really pretty and they've gone through the program and are very smart and they deserve the jobs they get. But I think for the most part, I can generalize the women that go here and I am in no way impressed by them (A-2).*

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INTRODUCTION

Though some men student engineers described women's place on campus in less-demeaning terms, this dialogue (of representative responses men student engineers gave during cultural-identity interviews) illustrates the common wisdom about women's place on one engineering campus. Here, women student engineers face a central cultural hurdle that is made apparent in the talk about what kinds of persons belong in engineering. At Public Engineering School (PES), there are no terms for talking about women engineers *as* engineers, as members of the engineering community. While practicing engineering (for 15 years), I realized that women did not "belong" in engineering, but could not put my finger on why. Only after leaving engineering to pursue interests in the education of girls and women for math- and science-intensive careers did I begin to appreciate how engineering culture perpetuates itself as male-dominated and constructs women on its margins.

Over the last 10 plus years, in conversations about leaving engineering, many former engineers and scientists, women and men, summarized their reasons with one phrase: "I couldn't believe what I had *become*." This notion of "becoming" motivated my research as I followed how women and men student engineers developed engineering identities at PES, especially how engineering-student cultural identities flow with and through gender, learning and knowledge, and relations of power. Rather than investigating ways to change girls and women to make them an easier fit with engineering customs, I focus on the circumstances in engineering education that make it a place where women are neither welcome, nor taken seriously.

This paper emphasizes the kinds of persons that engineering education produces, those cultural identities taken for granted at PES to connote belonging, those that give strong messages about not belonging, and those that are missing. If, as Lave and Wenger (1991) assert, identities play a key role in motivating learning to be a participant in a community of practice, then it is crucial to know just what sorts of engineering-student identities exist in engineering education and who is included or excluded from them? Though the research literature is largely silent on such identities (Eisenhart, 1996, being a notable exception), I expected to find a cultural system of belonging that provides a cultural lens on what makes it difficult for women to become full-fledged members of engineering. In particular, I look for the "ways in which the stable and enduring features of our everyday world are assembled through historical processes and in concrete social settings,...[and how] people's everyday practices exhibit, indeed generate, the social [and cultural] structures of the relevant domain" (Mehan, 1993, p. 243).

Women in Engineering

Apparently engineering works on women in ways that are markedly different from its impact on men. The continuing imbalance in the numbers of women and men studying and

practicing engineering perplexes me. Even 25 years after legislation removed the formal barriers that had kept many women out of engineering, women (in 1993) accounted for fewer than 15% of the degrees earned in engineering and fewer than 8% of engineering jobs (NSF, 1996). Since the early 1980s, the rate of increase of women in engineering has declined and has been virtually level since 1985. While this trend paralleled that of all academic disciplines (Jacobs, 1995), engineering remains the most male-dominated area of academic study among scientific and engineering professions.

Seymour and Hewitt (1997) investigated the reasons undergraduate science, math, and engineering (S.M.E.) students leave these disciplines. S.M.E. faculty perceive these students as appropriately leaving S.M.E. majors because of student deficits: "on the one hand, wrong choices, under-preparation, lack of interest or ability, incompetence, incapacity for hard work, or, on the other, by the discovery of a passion for some other discipline" (pp. 391-392). Seymour and Hewitt systematically disprove each of these misperceptions. In fact, their data show that those students who leave S.M.E. majors are indistinguishable from those who stay. Seymour and Hewitt report that "a far greater contribution to S.M.E. attrition is made by problems which arise from the *structures of the educational experience and the culture of the disciplines* (as objectified in the attitudes and practices of SME faculty) than by problems of personal inadequacy, aptitude for other disciplines, or the appeal of other majors" (p. 392, emphasis added). They articulated their sense of the depth of changes needed before women would find science, math, and engineering disciplines welcoming:

> Programs for women which seek to address attrition solely by reconciling the relatively few women who use them to a learning environment which is inherently opposed to the needs of female S.M.E. [science, math, and engineering] students as a whole, are doomed from their inception. Those S.M.E. faculty who are serious about making the education they offer as available to their daughters as to their sons are, we posit, facing the prospect of dismantling a large part of its traditional pedagogical structure, along with the assumptions and practices which support it. (Seymour & Hewitt, 1997, p. 314)

I wondered if recent reform efforts in engineering education, especially adding innovative engineering design courses to the engineering curriculum, would in fact have this dismantling effect. I was to find that even in courses where the "pedagogical structure" was ostensibly dismantled, underlying cultural practices prevailed.

On another front, McIlwee and Robinson (1992) provide the most thorough investigation of women in engineering to date. Working in 1986, they identified a random sample of 1000 graduates (from 1976-1985) from electrical and mechanical engineering programs at two public engineering colleges in southern California. One of the universities was an elite site (CEU - California Elite University) and the other less so (PSU - Public State University). They focused on electrical and mechanical engineers because they are the largest engineering specialties and both are rapidly growing. Former students received a survey that 65% completed and returned. Of

these, 263 respondents indicated a willingness to participate in follow-up interviews and, from this pool, 30 men and 53 women were randomly selected and interviewed. This sampling technique allowed McIlwee and Robinson to compare the work experiences of similarly-educated women and men. The survey covered work backgrounds, attitudes toward their work, things about work that bothered them, and background about their outside-of-work (family) lives. The in-depth interviews elaborated on work histories, current jobs, educational histories, and family situations. With this research method, they could follow engineers from high school, through college, and into the workforce at a variety of companies.

McIlwee and Robinson found that most women became engineers because of their math and science skills in high school. They worked hard in college and thrived on the academic challenge. In college, where professors (who are engineering faculty and closely affiliated with academic goals and not practicing engineers *per se*) value academic performance above all else, women's academic talents were recognized and rewarded. However, women's lack of tinkering skills - which were not remediated at college - led to women feeling insecure about hands-on competence. Though hands-on skills played only a minor role in college success, when women moved into jobs, their lack of tinkering skills quickly became a salient feature that marked women as not belonging.

Women graduated from college and found well-paying jobs, receiving starting salaries at or above their male counterparts. However, within 10 years, women occupied lower-status positions than men. According to McIlwee and Robinson's respondents, different types of engineering work have different prestige (pp. 80-82). The hierarchy they elicited encompassed both engineering and engineering-management jobs (listed below from high status to lower status):

Managers:
Upper management with corporate-level responsibilities
Mid-level management with responsibilities for a portion of the production process
Senior engineers and project managers, supervising other engineers

Engineers:
Design engineers, who create new "solutions" or technologies
Research and development engineers, who put new technologies into production
Production engineers, who maintain production processes
Sales and marketing engineers

Moving up the status ladder distanced engineers from the non-engineering world and managers from practicing engineers.

McIlwee and Robinson found women in less prestigious jobs than men. This could not be explained by differences in education or career continuity. Furthermore, "...a significant number of women who started their careers in high-status design jobs actually experienced *downward mobility* over time" (p. 84, emphasis theirs). The disparity between women and men engineers could not be explained by differences in work-related values. Though women's self-confidence

and assertiveness were lower than men's, these factors could not explain the employment disparities. That is, "women with high levels of self-confidence and assertiveness are not found in higher status positions as consistently as their male counterparts. Moreover, the work positions of women are not helping them build these resources, as they are for men" (p. 93).

By looking closely at the experiences of women in aerospace and high tech firms (not via *in situ* fieldwork observations, but via in-depth interviews), McIlwee and Robinson conclude that the more important feature of engineering workplaces is the extent to which engineers hold power in the firms, especially "power to enforce a culture of aggressive, technically-oriented engineering, to create a work style comfortable to them as men" (p. 138). "[W]omen's mobility is greatest where the culture of engineering is minimized by bureaucratization and affirmative action...[and] this tends to mitigate the emphasis on male-defined displays of technical competence, to the benefit of women" (p. 138). For McIlwee and Robinson, "it is women's membership, not their competence, that is at question. They do not conform, or more accurately, do not *appear* to conform, to the culture of the workplace" (p. 138, emphasis theirs). In particular, the lack of interactional resources - hands-on skills, self-promotion, and self-confidence - places women at a disadvantage.

McIlwee and Robinson chronicled an engineering power hierarchy and women's subordination within it and I found another such power hierarchy at PES. In this paper, drawn from a larger research project (Tonso, 1997), I examine women student engineers situated in an engineering education culture, delineate the relations of power being promoted, document how various conceptions of learning and knowledge are linked to power, and demonstrate how current cultural practices subordinate women. My fine-grained analysis revealed that women's purported lack of interactional resources had little to do with their "disadvantage." In fact, my focus on courses explicitly organized to "remediate" hands-on skills and other interactional resources (e.g., technical drawing, communications, and teamwork) will demonstrate that women engineers with a full measure of interactional resources (of the sort McIlwee and Robinson found lacking) do not, and cannot, *belong* as engineers at PES. The dilemma that McIlwee and Robinson articulate is not about women and their engineering skills, but is rather about the myriad ways that engineering cannot recognize women *as* engineers.

Public Engineering School

Public Engineering School (PES) is a state-supported college of engineering with programs typical of those at many engineering colleges. Undergraduate engineering enrollment was close to 2300 students, about 14% are ethnic minorities[1]. PES is coeducational and always has been.

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[1] Though I intended to study issues of race and ethnicity, students from minority groups seemed too "recognizable" to secure their identities. Not only were there few student teams with more than one minority student, but also minority students seemed to come to the attention of faculty to a greater degree than their white colleagues. I found the same "over-exposure" safety concerns for anyone perceived as not living up to the heterosexual norms of the

Women students comprised over 20% of the undergraduate enrollment (somewhat higher than the 18% average nationally, reported in the American Society for Engineering Education's 1995-1996 Survey). I chose PES because it stood out as an engineering college with more women students and professors than national averages, as well as considerable collective will to address concerns about women's education in engineering. PES promoted learning more about the practical side of engineering by adding engineering design classes to their curriculum over a decade ago. Every student took design courses during their first, second and fourth years of study - a total of 6 semesters of study, though only about 11% of their total course load.

Engineering design classes are a serious attempt to change the shape of engineering education and to accord status to the more-practical side of engineering. Design projects are considerably larger than textbook exercises, requiring teamwork for successful completion. Since teamwork is the industry norm, learning to work in teams is considered necessary training for all engineers. Design classes have the potential to incorporate complex real-world projects that are similar to those faced by practicing engineers, instead of the approach taken in conventional engineering courses that center on smaller bodies of knowledge, abstracted from the real world, with neat, clean, one-right-answer solutions. As innovative engineering courses expected to extend the "book-learning" of other courses, engineering design courses provide opportunities for teams of student engineers to complete real-world, often messy, projects that require not only gathering information from clients about their needs and interests, but also applying scientific, mathematical, and engineering principles to specific situations, as well as learning to communicate with industry employees ranging across the workplace from hourly laborers, to engineers, engineering managers, and non-technical managers.

I selected classrooms taught by engineering educators known for their skills teaching engineering design and recognized for their contributions to women's participation in engineering. Within these classrooms, I selected teams of women and men students, choosing only teams with more than one woman. I followed three teams in a one-semester, first-year, engineering design class (seven women and five men) and two teams in a two-semester, senior-year, engineering design class (four women and seven men).

The research methodology for the larger study encompassed primarily qualitative data sources, with an emphasis on ethnography:

- a curriculum analysis (after Nespor, 1990),
- a survey of students' perceptions of the differences between design and non-design engineering courses (274 students split almost evenly among design and non-design courses at first-year and senior levels, including women and men in proportions representative of campus populations; analysis using multiple analysis of variance, MANOVA),

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campus culture. Both of these issues deserve far more study using a research design that better ensures anonymity.

- a paired set of interviews that elicited engineering-student cultural-identity terms and their categorization (analysis after Holland & Skinner, 1987), and
- in-depth participant-observation of student teams and classrooms, and ethnographic interviews of students on teams and of professors of design classes (analysis after Spradley, 1979, 1980; vignettes written ala Van Maanen, 1988).

This paper depends heavily on locating women's place (or lack thereof) in the decontextualized cultural-identity categories and on documenting how students practice engineering in ways that cohere to cultural pasts while engaged in the everyday world of senior students' engineering design teamwork. As will become evident, the production of Woman as not belonging among engineers becomes a demonstration of membership in the community of practice.

I suspected that engineering identities played a key role in women's marginalization. To investigate these matters, I wondered:

- What are the varieties of engineering-student cultural identities in the PES community of practice and how are cultural-identity categories organized?
- How are these identities manifested, constructed, acted upon, and engaged during the everyday practical activities of teamwork associated with design classes?
- Where do women belong in these identities and practices (or not)?
- How does cultural power, that is built into, and produced by, the cultural system, shape the everyday practices of engineering education and produce women's invisibility?

WOMEN'S "PLACE" IN ENGINEERING EDUCATION

In this section, I summarize the cultural-identity terrain (Tonso, 1997, contains a thorough explication), discuss how senior students enacted identities as they went about their engineering design teamwork, and illustrate how belonging at PES ultimately meant not-belonging for women as engineers. At PES cultural identities configure the playing field upon which student engineers learn to practice their profession.

Embodied Practices in Engineering-Student Cultural-Identities

Mature-practitioner identities, according to Lave and Wenger (1991), motivate becoming a member of a community of practice. In addition to speaking as if each community of practice was headed toward a known final endpoint, such as tailor or butcher, Lave and Wenger provided no methodological route through which to elicit cultural categories of mature-practitioner identities from community members. I filled this gap by modeling my mature-practitioner data-collection strategies after Dorothy Holland and Debra Skinner's (1987) study of the cultural models behind Americans' talk about gender types. Using a two-stage elicit-and-sort interview protocol, I first elicited cultural-identity terms from 17 student engineers (6 women and 11 men), asking them to

list "all of the terms they use to refer to each other as student engineers" and to describe each of the terms in the list. I labeled these the "A" interviews and numbered student interviewees A-1, A-2, etc. After eliciting terms, I made a comprehensive list of terms (from audiotape transcripts) and counted the number of students who gave each term. There were 36 terms (listed here with the number of students who gave the term):

Table 1: Most-Prevalent Identity Terms (asterix indicates female-marked terms, others are male)

slacker	10	over-achiever	2	betty*	1
nerd	9	dormie	2	super-engineer nerd	1
geek	5	dork	2	loner	1
jock	4	greek	2	technogeek	1
frat guy	3	frat boy	2	computer whiz	1
PES-woman*	3	fraternity man	2	nerdboy	1
sorority girl*	3	sorority woman*	2	typical engineer	1
squid	3	brown-noser	2	hacker	1
studious	2	leader	2	computer-nerd	1
follower	2	anal	2	enginerd	1
big-man-on-campus (BMOC)	2	hard-core over-achiever	1	curve-breaker	1
hard-worker	2	sorority chick*	1	frat brother	1

I created a deck of terms that included every term that more than one student mentioned, as well as terms mentioned only once in the interviews but that I heard elsewhere during classes and team meetings.

In the second stage (sorting), I asked 11 student engineers (4 women and 7 men, all of whom had been "A" interviewees, as well as being seniors on the design teams I was following closely) to sort the most frequently elicited terms into "categories that make sense to you" and to "tell me why you put terms together in each group and to describe how the categories differed." The timing of the sorting (identity) interviews coincided with my fieldwork in senior design and came at the end of my final ethnographic interview with senior student engineers. I labeled these the "B" interviews and numbered student interviewees B-1, B-2, etc.

Cultural-Identities at PES

Three cultural-identities categories emerged in the cultural model underpinning student engineers' talk about belonging at PES: Greeks, Academic-Achievers, and Nerds (Fig. 1). Students lumped Greeks and Academic-Achievers together into a super-category they referred to as Over-Achievers. Within each of the three categories, a rich discourse about belonging in engineering education developed. For men, belonging meant having a wide variety of ways to practice engineering recognized in the culture. For women, belonging was a far more constrained set of possibilities; none of which connoted belonging as an engineer.

Status organized the categories relative one to the other. Belonging among high-status

Over-Achievers, relative to the Nerds, denoted over-achieving along one of two dimensions: socializing or studying. For Greeks, over-socializing implied not only spending inordinate amounts of time at parties and other sorority and fraternity events, but also participating in campus-wide "leadership" roles on committees relevant to student life and becoming visible in the campus administrative realms. For Academic-Achievers, over-studying meant coming to the attention of the faculty and subscquently the campus administration via near-perfect scores on homework, projects, and in-class exams, and ultimately stratospheric grade-point averages. For Over-Achievers, the extent to which one was willing to take advantage of other people in order to maintain one's status in the PES success system delineated ethical and unethical Over-Achievers. Terms near the middle of the Over-Achiever map (Fig. 1) refer to respectable ways to practice over-achieving: studious, hard-working, over-achiever (among Academic-Achievers) and greeks, fraternity man, fraternity brother, sorority woman (among Greeks), plus the term leader which links Greek and Academic-Achiever categories. On the other end of the spectrum, students referred to the unethical uses of power by saying someone "went too far." The went-too-far cultural identities include: hard-core over-achievers, anal, brown-noser, and curve-breaker (among Academic Achievers, up and to the right on Fig. 1), and frat boy, frat, guy, jock, BMOC, and slacker (among Greeks, up and to the left on Fig. 1).

Among Over-Achievers, no terms refer to women among Academic-Achievers and only five Greek terms refer to women: sorority woman, sorority girl, sorority chick, betty, and PES-woman. Sorority woman is the only respectable term, while sorority girl, sorority chick, and betty provide camp-follower identities for women. All five are thought of as men's subordinate social partners in a normatively heterosexual social organization (Eckert, 1993; Holland & Eisenhart, 1990; Horowitz, 1987). PES-woman has a special status that I will discuss in a moment.

Belonging among Nerds indicated a commitment to understanding how engineering, scientific, and mathematical principles (ostensibly learned in conventional engineering courses) gave meaning to complex, real-world situations. Though Nerds spent a large part of their time socializing and studying, it was making sense of the real world that motivated their engineering practices. Among Nerds, some kinds student engineers were "normal": computer whiz, technogeek, computer nerd, nerd, nerdboy, super-engineer nerd, and enginerd (to the left on the Nerd map, Fig. 1). In a variety of ways, these terms indicate plugging away and surviving the fast-paced engineering curriculum. Other terms indicated students who were in a variety of ways devoid of social skills: hacker, squid, geek, dork, dormie, and loner (to the right on the Nerd map, Fig. 1). Among Nerds, no terms include women.

Cultural-identity terms indicate an elaborate categorization of ways to practice engineering. Allow me to illustrate this by discussing Nerd identities. (See Tonso, 1997, for an explanation of Over-Achiever terms.) Many students began the recitation of terms in the elicitation interviews by

saying "we're all nerds." The term "**nerd**" is at the core of this category. As one student put it, "a normal person [here] is pretty abnormal [in the general population]" (A-1). It is "not that bad to be a nerd, because nerd can be great. That's what everybody is trying to do, work a lot...and [take school] serious[ly]" (A-9). Being a nerd and studying too much is an engineering school survival skill, because "school almost dictates that you study a lot in order to get your work done" (A-11).

Three other terms incorporated "nerd": enginerd, super-engineer nerd, and nerdboy. As one student explained, "enginerd, super-engineer nerd, and nerdboy are affectionate terms. [These are the people that you] make fun of, but are glad they're here" (B-6). **Enginerds** can turn ordinary conversation into an engineering analysis, a kind of engineering word-play. For example, one student told of a conversation he had with his roommate, also an engineering major. "When I was watching a baseball game with my roommate, we noticed the pitcher's ERA [earned-run average] was pi over 2 [half the ratio of the circumference of a circle to its diameter or about 1.57]" (A-6).

Super-engineer nerd refers to students who combine real-world practical knowledge with technical and scientific principles. "[They] figure out the theory and the math behind it and you've already got all the practical knowledge, so he could build just about anything....I would have classified [one student I knew] as a super-engineer nerd, because he read technical manuals for fun and had catalogs of resistors by his night stand" (A-16). A super-engineer nerd "can crank out something, thinks about it all the time, and is really in love with this type of stuff....They can go crank stuff out....Someone who does the stuff for a hobby, who has the catalog for a hobby, and builds these things in their basement on weekends" (B-3).

Nerdboy refers to a friend who is on the verge of over-studying, of crossing the line from studying a lot to studying too much. One student was called nerdboy because "he knew all about H-P calculators and computers, [was] good with AutoCAD [a computer-aided drafting program], and got a 98 on an exam" (A-4). Another student used nerdboy (and in his case nerdgirl) when "I'm trying to be a slacker and someone else is trying to put forth effort on something. I want to bring them down to my level....[Calling them nerdboy means they are] like the human study machine, just because it makes you feel better because you're blowing [studying] off" (B-3).

The "nerd"-terms operated in two ways. First, being "nerd-like" implied separating from non-engineers, a way of claiming affiliation with engineering. Second, among engineering students, identity terms that incorporated "nerd" regulated within-group behaviors. Student engineers gave their colleagues not-so-subtle feedback on their behaviors by reference to less-than-desirable identity terms. Whenever students made what might be called bone-head mistakes, their colleagues said, "You nerd," implying their engineering skill was suspect.

Moving away from the "nerd"-terms in the lower left of the identity map and towards the top indicates increasing fascination with computers (Fig. 1). Most students on engineering

campuses are adept computer users; those who exceed that norm get special names: computer-nerd, technogeek, computer whiz, and hacker. **Computer-nerds** "socialize with their computers" (B-1). "All they do is sit in front of the computer. They don't have a social life; they don't interact with people; they're just trying to debug the next program; they're trying to come up with another language. [It] makes no sense to any other individual" (A-15).

By comparison, **technogeeks** are not considered social outcasts, but they are thought of as people who "know all the facts about anything: cars, computers, new inventions" (A-11). By adding the "-geeks" suffix, student engineers signal an over-zealous collection, and often unwanted dissemination, of trivial technical information.

Computer whiz is "a term of respect for someone who's gifted with computers" (B-3), but whose computer expertise has not resulted in isolation from other people. Computer whizzes "can do anything on a computer and they enjoy it" (A-11). "...[T]hese are the people you go to when your computer has a virus" (B-5). Having a computer whiz on your team means having an especially knowledgeable computer user who enjoys helping solve problems that are beyond the skills of most students. In addition, being a computer whiz implies a willingness to help other students out of their programming jams.

Also in the computer-affiliated area, **hackers** are "gifted at computers and [are] pushing the boundaries of computer technology [sometimes finding holes in surveillance and security software by unauthorized entry to computers] and some are destructive-minded" (B-3). "You see the same person on the same computer every day, just surfing the net" (A-13) and "trying to hack [gain unauthorized access] into computer systems" (B-8). Though computer whizzes use their advanced computer skills to provide assistance to others, hackers are on a solo mission and impervious to social interactions with non-hackers. On this engineering campus, computer whizzes were plentiful and hackers were rare. Being a computer whiz implied using prodigious computer skills to succeed academically and to fit into the engineering community, but hackers' increasingly sophisticated computer knowledge served to bypass academically successful endeavors, risking a one-way ticket out of engineering college.

Moving to the right on Figure 1 indicates declining social skills and undesirable engineering identities: squids, geeks, and dorks. **Squids** are "nerds of the nerds, chained to their desks, who perform well in school" (A-12), "but have to work at it" (A-7). Squids "are studious to the point of absurdity and spend a lot of time in the library. They may not be effective [studiers]" (B-3). By working so hard in school, squids "have no social balance in their lives because they spend all their time in the library" (B-8). Squids are "really good to have on your team [because] they do all the work" (A-12). In particular, the public display of over-studying, especially in the library where one cannot talk, snack, or be interrupted easily, was ridiculed.

Geeks "lack social skills and the ability to communicate with others. "Geeks don't do

anything on weekends, but study on Saturday and go to bed at 9 [P. M.] on Friday" (A-6). These are the people "who sit in the front of classes and want to look smart by asking teachers questions that either they already know the answer to or the answer is not important" (A-6). In fact, geeks "sit in front of the class, [have their packs open and] are disorganized and sloppy, have no life, [and you want to ask] 'do they do anything?'" (A-4).

Dorks are the "true" social outcasts among student engineers. "They don't fit in and are obnoxious" (B-6) and are "somebody that's annoying and bothers you" (A-9). Where nerds, squids, and geeks are academically successful, dorks are less so. In fact, they are "proven wrong a lot and they piss you off because they do okay, but they don't deserve it" (B-6), an allusion to students who "get where they are by ass-kissing" (B-11).

The final two terms on the Nerd map, dormies and loners, are even more asocial than dorks. **Dormies** live in the dorm, "have no desire to get out on their own" (B-1) (an indication of immaturity), "are quiet and studious" (B-1), and "have nothing better to do than watch TV" (A-12) or "play computer games on Friday night" (B-2). **Loners** are those students that no one knows because they are "not hugely social people and like to work in their room" (A-13), implying they do not associate even with other dormies, much less the socially-active student engineers.

Whereas Nerd cultural identities provide several ways to practice engineering, no Nerd terms include women. Explaining this one of the students told me:

> You don't think of women as [Nerds], because (at least at this school) I think guys here so much appreciate that a girl chose to come to this campus that you're just like 'Great!' [In contrast to the small number of women here, about 25% of the student body], there are so many guys that you can say 'This guy's a nerd,' the pocket-protector wearing guy (A-16, a man).

In this comment, he describes how student engineers used identity terms to delineate nuanced variations among men student engineers whose larger numbers made it easier to see salient aspects of identities, then he infers that men students think about women *as* women and not as belonging in taken-for-granted engineering-student cultural-identity categories. This provides clues about women's "otherness" at PES. There are no female-marked terms among Nerds. A similar void is evident among Academic-Achiever terms. And among Greeks (the social Over-Achievers), only one respectable term exists and the rest are (some) men's pejorative stereotypes of women.

This proved to be an especially troublesome issue for women senior students. Two of the four women senior student engineers (Pam and Marianne) demonstrated engineering practices that would otherwise place them among the Nerds. Had they been men, I feel reasonably certain their colleagues would have thought of them in super-engineer nerd or nerdboy terms. Why is it that women who behave in culturally-marked ways, when men are concerned, are not recognized or noticed by these cultural-identity frameworks?

PES-Woman - Being "Othered" in Engineering Education

PES-woman is the only cultural-identity term that cuts across cultural-identity-category boundaries, and *personifies* contradictory meanings. Among Nerds, PES-woman was affiliated with dormie and loner; among Academic-Achievers, with studious, hard-working, leader, and typical engineer; and among Greeks with the over-partying sorority chick, frat boy, and frat guy. Furthermore, because PES is the stand-in for the campus name, PES-woman appears to apply in equal measure to all women students on this campus. Its parallel at other colleges would be Vassar-woman or Harvard-man. How could an identity term simultaneously connote "what's good about engineering," a loner, and someone who parties too much, as well as stand for all women at PES? Whereas other identity terms demonstrated subtle shades of meaning that referred to ways to act like an engineer, PES-woman was located in a wide variety of social and cultural positions on both the Nerd-dom and Over-Achiever maps. The inconsistencies and contradictions of meaning signal that PES-woman is different from other cultural-identity terms. I argue that historically PES-woman had been, and to some extent still was, a catch-all "other" term for women and that its meaning as "other," though contested by women and some men, was little changed over the period during which women's numbers increased at PES.

Students gave these descriptions of PES-woman[2] which I list in three groups ranging from pejorative to favorable:

Pejorative:

- "Big, easy, sluts [who] go to school here. If she's pretty, guys ask her out too much and, if she goes out with them, she bombs out of school because she doesn't study enough. [Hence,] the women who stay aren't pretty" (A-2, male)
- "Bitch, slut, whore, and really conceited" (A-4, male).
- "Unattractive; they go out with brown-nosers; they're not really smart, [but are] stuck up and snobby" (A-12, male).
- "An offensive term [used to characterize] women we're stuck with because we go to this school, but I don't use it. I dated a PES-woman for years" (B-3, male).
- "Stereotypical, demeaning [term for a woman who is] unattractive, studies too much, is overweight, and the b-word [he would not utter "bitch" in my presence]" (B-5, male).
- "[When other students use it, they mean a woman who's] unattractive [and] just at [this school]" (B-7, female).
- "A big filing cabinet for sticking people into,...standard-issue stereotype [of women as] overweight, unattractive, and picky about men" (B-8, male).

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[2] Notice that, in four of these statements, students used gender-less terms, "people" and "person," to refer to women. I found this curious and suggestive of ways women become "one of the guys." Without further analysis, I am uncertain of the significance of this use of de-gendered language for such conspicuously-gendered terms.

- "A [negative] stereotype and not [descriptive of] the majority of women here" (A-10, male).
- "Can be bad on a team, like a slacker" (A-12, male).

Neutral:

- "Friends with people in sororities" (B-1, female).
- "[In the group with] just typical people, just your average person at [this school]" (B-11, male).
- "Normal people [that] I hang out with" (B-2, female).

Favorable:

- "[I use it to mean] a very distinguished way of saying women engineer..., [but most other students use it as] condescending, [women who] just go to [this school] to get a guy or they have it easier because they're a girl" (B-4, male).

Five of the eleven men informants said they did not use the term, though they knew what most people meant by it. One man student engineer straddled the fence, saying he used the term, but thought he should not be doing so, especially since his girl friend was also an engineering student on this campus. The remaining five men student engineers used the term and expressed no concern with doing so, even when they knew I was a former woman engineer.

All of the six women students who participated in one or both of the identity interviews had heard the term and knew what it meant, but shrugged off answering if I asked for more information beyond how other students used the term. Because of my desire to keep them talking and to refrain from hurting them, I did not vigorously pursue questions about how it made them feel or what they said to men who used it to refer to women. Based on my on-campus observations, they acted as if they ignored its use and said nothing. I never heard this term used outside the identity interviews and only two students (both among the went-too-far Academic-Achievers) volunteered the term without my prompt for "terms that refer only to women."

As a woman engineer and former student engineer, hearing men use this term, even in the controlled circumstances of an interview, nauseated me. I remember literally having to force myself not to throw up when I asked about this term. I felt shamed as a woman and as an engineer; I was ashamed of students I thought of as engineering colleagues. Even now in the retelling, my stomach is queasy and I fold my arms across my chest, as if I were protecting myself. I cannot speak for other women students or engineers, but, except for the fact that I felt compelled to complete my data collection, I would never have uttered this word out loud on campus. To do so would, in some rather perverse way, have given it validation, as if it could be true of women who studied engineering at PES. I suspect that in earlier times I had a thicker skin, but as I performed my data collection I was too sensitive to what was going on around me and was far more vulnerable than I would have admitted at the time.

Via this term, women student engineers were constructed as deficiently woman if they were successful engineers and deficiently engineer if they were successful women. PES-woman represents (some) men student engineers' discourse about engineering womanhood and works to distance men from any "woman-ness" among engineers. Women did not use PES-woman and did not offer it in elicitation interviews, but all women have heard it and can explain its usual meaning. Some men student engineers refused to use this term or they used it in markedly different ways during their interviews, though they too knew how it was meant on campus.

PES-woman encapsulated notions about women engineers' lack of physical attractiveness, as well as the disapproval of women who dated too much or were thought of as promiscuous. It also linked good looks and sexuality to lack of academic success, as well as linking lack of attractiveness (to men) with academic success. This term is different from other PES cultural identity terms, which depended on observable actions and behaviors relative to engineering studies, but not to men's looks or sexuality.

Furthermore, PES-woman had been around for many years. A professor of engineering, on this campus for over 30 years first as a student and now as a professor, told me that PES-woman was in use when he arrived. Engineers I knew who attended PES over 25 years ago recalled that PES-woman held only pejorative meanings in those days. It was used as a put-down of women. My PES-alumni friends told about a cartoon in the school newspaper (circa 1970) that showed a caricature of two women - described as looking like East-German shot-putters, muscular, hairy, and overweight - walking across campus, carrying their books with one hand, and dragging the knuckles of the other hand. The caption referred to the "Coed Panzer Division," alluding to women students as broad in the beam, slung low to the ground, and ugly (by some men's sex-object standards).

Though women students possessed a wide variety of body shapes and sizes, PES-woman stereotyped their looks in demeaning ways and cast aspersions about their credentials for studying engineering. PES-woman was hardly a new identity term on this campus and its usual meaning was little changed in the last 25 years when women's numbers have grown significantly (from about 1% of undergraduate students in the late 1960s to over 20% now). Today, however, some men student engineers objected to the historic meaning of PES-woman, did not use it in that sense, and one used the term in respectful ways.

Was being a woman, as constructed at PES, contested and unstable? Or were the more-respectful comments in the cultural backwaters at PES? I could not tell from the identity interviews alone. Since Holland and Eisenhart located gender meaning-making in peer groups, I anticipated finding that student teams might be a site where different expressions of womanhood developed. My ethnographic research component suggests not only that women student engineers do not meet any of the "criteria" for PES-woman, but also that PES-institutionalized, what I refer to as

"engineering gender," marginalized woman, as a social category, and subsequently women student engineers were made invisible as engineers. Let us turn our attention to the senior teams and watch how everyday practices provide opportunities to make sense of practical engineering work through the cultural lenses encoded in the cultural-identity framework.

Practicing Engineering in Senior Teams

Over the course of two semesters, I followed two very different senior teams (Tonso, 1997). Each team worked for an industry client with roots in or affiliations with electrical generation power plants, and both projects had something to do with protecting the environment. I call them the Mercury Team and the Sludge Team in reference to the kind of project they completed. Table 2 lists the students on each team.

Table 2. Students on the Senior Teams

	Engineering Specialty	Years to Graduate	College GPA*
Mercury			
Pam	Chemical Engineering	5 + summer school	Moderate
Carol	Electrical Engineering	4	Moderate-High
Carson	Mechanical Engineering	5	High
Pete	Chemical Engineering	4 + summer school	High
Shane	Chemical Engineering	4 + summer school	High
Samuel	Chemical Engineering	4	Moderate-High
Sludge			
Jessica	Electrical Engineering	4	Moderate-High
Marianne	Mechanical Engineering	5	Moderate
Martin	Electrical Engineering & Computer Science	5	Moderate-High
Nate	Mechanical Engineering	4	High
Russell	Mechanical Engineering	4 + summer school	High

* High ≥ 3.8, Moderate-High 3.3-3.8, Moderate 2.9-3.3

The Mercury Team worked for A-Tech, a small company that specialized in developing environmental technology for industrial users. The team created a mathematical model of a proprietary technology for removing mercury from power-plant flue-gas emissions. This kind of technology is used, on a much smaller scale, in catalytic converters on passenger cars. Thinking of a power plant in terms analogous to a car meant that the Mercury Team was designing a catalytic converter that will be about the size of a high school gymnasium. Highest-status students on this team (Pete, Shane, Carol) shirked their part of the work, volunteered for high-visibility public performances, and exploited their hard-working colleagues; while Carson a did some engineering work, controlled some of the public performances, and grilled Pam about her engineering work. Pam and Samuel practiced magnificent "actual" engineering, the melding of scientific and

engineering principles with real-world, site-specific, technical and non-technical constraints. Pam became the heart and soul of her team's engineering, while Sam supported her efforts without challenging his higher-status colleagues. Pam was invisible in the public spaces where professors and company-engineers observed the team's engineering products, and suffered both exploitation of her work by some of her non-contributing teammates (Carol, Shane, and especially Pete) and academic hazing from Carson, otherwise a capable colleague.

The Sludge Team worked for Private Power, the owner of a power plant located adjacent to their largest customer, a manufacturing plant. As with many large manufacturing plants, waste from manufacturing processes and shop floors was collected and disposed of according to government regulations. Many plants bury the waste at considerable expense, but this manufacturing company incinerated it in Private Power's power-plant boilers, also at considerable expense, due in large measure to the maintenance costs on a complicated system of piping, pumps, and nozzles. The team designed a PC-based data-acquisition system to monitor a portion of the sludge-disposal facility. By monitoring the back-pressure on the outlet side of the sludge pumps, the Sludge Team planned to gather information to better understand the pumping system, information the company would use to reduce maintenance costs. Their teamwork practices exhibited respect for one another, shared decision making, and a closer link with their design project than was the case on the Mercury Team. However, Jessica and Russell, students with higher-status identities, did less work, though not to the extent of the "slackers" on the Mercury Team. In ways that regularly impressed me, students on the Sludge Team practiced engineering of professional caliber; in fact, comparable to what I came to expect during my 15 years practicing engineering. Marianne, Martin, and Nate were the premier engineering practitioners on this team. Though in many ways very similar to Pam on the Mercury Team, Marianne's teamwork experiences were vastly different from Pam's.

In the following vignettes, we join these teams as they work through their day-to-day engineering practices. I begin with a Mercury Team meeting and illustrate how two Academic-Achievers with went-too-far cultural identities interacted with a less-powerful Nerd. This was the only instance where I saw anyone take on a student from the highest status category. Then, I provided a glimpse of how Carson hazed Pam, along with how Pete exploited everyone. Next, I turn my attention to the Sludge Team and illustrate the very different kind of experiences Marianne had on her senior team. Finally, we visit a whole-class meeting to see how Marianne's standing up for women's interests in this context did not elicit the same kind of support for these concerns that she had come to expect in the team setting. Taken together, these events illustrate how differentially powered student engineers socially construct the everyday practices of campus life.

Interactions Among Higher-Status Men Students and a Nerd Man

On the Mercury Team, Pete and Samuel had volunteered to give the team's first in-class oral presentation. This public performance would be graded by each of the six faculty team-teaching the course and observed by the other teams. To prepare, Pete and Samuel met outside of the team meeting, organized their talk along the lines suggested by professors, and divided up the topics to be covered. They gave the rest of the team a run-through during the team's regular meeting, about two hours before the whole-class session when they had to perform. Samuel and Pete expected to give the run-through, then receive feedback from their colleagues about ways to make it better. In particular, they did not seem too concerned that there were some large gaps which their teammates would have to help them fill in. After the first run-through, there were some obvious flaws with the presentation and Carson launched into an attack of Samuel's portion (Field notes 9-28, p. 9):

Carson: Samuel, are you ready to go on? It's our first presentation and you don't seem real comfortable with what we're doing. You sound weak on lots of issues.

Samuel: What am I weak on?

Carson: Well, the way I heard it you're weak on everything.

Pete: (Turning to Carson,) I think you're going about it the wrong way. (And then to Samuel,) he's talking about your not knowing what kind of sorbant. [I think he's asking] do you want to work on it or do you want to pass it on [to someone who knows more about the particulars]?

Samuel: I can do it.

And later that day, he did. It took a few more practice presentations, but Samuel and Pete finally covered the material to Carson's (and the other teammates') satisfaction. Carson seemed to have no compunction with his heavy-handed approach, an all-too-typical social interaction for Carson. Pete jumped to Samuel's defense immediately and this was the onlytime when he did so. Over time Pete became ever-more-likely to make disparaging comments about samuel to their faculty advisor, especially giving the impression that Samuel was always late. This was the only time that Carson badgered Samuel and, ultimately, Pam became the target of Carson's over-zealous scrutiny. No one ever came to her defense however.

Interactons Among Unethical Academic-Achiever Men and a Non-Greek Woman

Carson and Pete, among the highest-status men student engineers I knew well, interacted with Pam in two inappropriate ways. Carson grilled her mercilessly about her engineering calculations; Pete exploited her and his other teammates. On example of Carson's tendency to use academic hazing as an interactional routine came at their February 15 meeting. As had become the team's custom, Pam arrived with several in-prgress sets of calculations and Carson focused his efforts on checking Pam's work, while he failed to meet his teamwork commitments.

While Pam churns out engineering computations, Carson and Samuel seem to be waiting for her results. At the other end of the table, Shane provides a running commentary as he thumbs through the equipment catalogues. Pete and Carol chuckle and nod at Shane's comments.

Carson: Well, are we going to be able to extrapolate the trend in the sorbant efficiency with time?

Pam: That's exactly what I'm inferring. (Pam answers him curtly.)

Carson: Well, where's the total amount of sorbant per day?

Pam: Why? (She's beginning to bristle.)

Carson: Well, so how much?

Pam: So 20 cubic meters lasts for 22 days. So divide them and you'll get it.

Samuel: So I get 253 kilograms of sorbant per day. The sorbant has one weight percent gold.

Carson: Well, I'm using different assumptions. So how much mercury is sorbed?

Pam: Well, the client and three professors told me to do it this way. What's the problem? (She's becoming more irritated with Carson.)

Carson: I'm not doing heat transfer. I'm doing how much we need. (Since Carson is supposed to be focusing on the heat transfer properties of the regeneration cycle, this is tantamount to his saying he won't do any work until she gets done with her part and he can pass judgment that she's done it correctly.)

Pam: Why? That's what I'm doing.

Carson: So we can check each other. What assumptions did you use?

Pam: None.

Carson: Well, I'll work through this and figure out what's going on and then we'll talk.

Pam continued to puzzle her way through calculating the surface area through which the flue gas must flow. After several more question-and-answer exchanges with Carson, Pam refused to answer him:

Pam: I don't know. Why isn't anybody else doing calculations? We only have one month to finish this up and I'm the only one doing calculations here.

Amazingly, her rather loud and angry accusation went unacknowledged. Her teammates did not flinch, shrug, nod, look away, or otherwise appear to notice. Carson spoke to Samuel as if Pam's accusation never happened.

Carson: (To Samuel,) did you get it done yet? Did your 0.326 alumina, did it include the porosity or not?

Samuel: Yeah. [I think he means that it did include the porosity.]

Carson: So 0.326 cubic meters takes into account this number (the interstitial porosity)?

Pam: I don't know. I'm doing it the way the professor said. I'm trying to work it up from first principles without assumptions. (She answers Carson curtly and seems to be angered that he continues to scrutinize her work, but does not make progress on the heat transfer calculations. She is in fact trying to take the interstitial porosity into account, but seems to lack the technical vocabulary for talking about it.)

Shane: Are we going to break for lunch?

Pete: Whatever.

Samuel: I need to go now, but we've got a half an hour before we have to get back together [for the regularly scheduled class time].

Within a few minutes, the team dispersed without making any decisions about what to do next. No one is hearing what Pam has to say about this project. Samuel is the only other student doing any engineering calculations. Carson, Pete, Carol, and Shane have done next to nothing that could be called engineering.

In late February, the Mercury Team realized that they had overlooked a key set of criteria - the extremely high flow rate of flue gas at the power plant must pass through the catalytic converter with virtually no pressure drop. The possibility of considerable last-minute revising sent teammates into a variety of activities. While Pam, Carson, and Sam took the bull by the horns and calculated their way out, Pete stayed on the margins and never quite understood the dilemma, but took credit for the team's work when their faculty advisor was present. Pete's actions indicate the most extreme kinds of tactics those with the highest status used to avoid doing engineering work, though he would ultimately take credit for the work doen by others.

At the team's meeting on February 29, Carson realized the seriousness of their problem:

Carson: So you want to buy extra sorbant to save money on a fan? A million cubic feet per minute, the flow rate of the flue gas, through 2/3's of a meter of [pore volume in the] bed, that is one helluva pressure drop. We have got a big bottleneck.

Later during the same meeting, Pete finally understands the import of Pam's and Carson's concerns by depending on them for technical information:

Pete: What's the speed of the flue gas?

Carson: Well, a million cubic feet, per minute,

Pete: What's the bed velocity?

Carson: Wind tunnel.

Pete quizzes Carson for the technical information needed, instead of making his own calculations. Something he repeats on March 7:

Pete: What about flow velocities through the bed? Did you come up with a way to get the gas to slow down? We can't expect the retention time to be OK if the bed is small. So with that cross-sectional area, stuff's going to be moving 140 miles per hour, through the beds. We need some residence time. I think we need about a tenth of a second. Well, if we had

one bed, it'd be a bigger bed.

Notice how Pete continues to see this as someone else's problem, not his. Rather than asking "How could we get the gas to slow down?," Pete asks "Did you come up with a way to slow the gas down?" Later in the meeting, Pete reverts to another of his trademark practices:

> *Pete: The problem is [we're] at the beginning of March and we're working with more than one bed all semester. I don't think we should switch now. We'd only make the switch if we had to by necessity. So we don't want to change it just to improve something, but because three beds wouldn't work. If we see that there's going to be a problem, we can go to two beds. So let's not change at this late date. We need to go through the whole thing again. Does anybody agree? What do you think about this?*

Pete takes his usual stance of advocating the least work possible, of deferring work as long as possible, and of gathering support for his position. Though he hardly understand the problem facing the team, Pete tells their faculty advisor that he discovered the problem. We rejoin the team-meeting dialogue as Dr. Stanley enters:

> *Dr. Stanley: Hi, everyone.*
>
> *Pete: You're late, buddy.*
>
> *Dr. Stanley: How's it going?*
>
> *Pam: Not too swift.*
>
> *Pete: Well, I'm going to take all the credit for discovering this problem. So they [A-Tech] did their experiment at a flow rate that's real slow. We've got a million cubic feet per minute to get down. So we're trying to figure out how to get that down, to anything, to get the velocity down. So we have to have a large surface area. So 100, 10-inch tubes is 200 miles an hour (an exaggerated velocity). That's going to blow the beads out. And if it fluidizes the bed, it's going to rub them [the beads] together and that's not going to be OK (in spite of Pam's repeatedly arguing that a fluidized bed is necessary).*

Pete contributed very little to resolving the dilemma of meeting the pressure drop criterion in light of the high flow rate. But this did not stand in his way when he took credit for "discovering this problem."

Pete and Carson exemplify men with the highest status on campus who exploited their teammates. When interacting with hard-working women students, such as Pam, these went-too-far Academic-Achievers not only ensured that she (and in some cases men with lower-status cultural identities, such as Samuel) would keep working and producing high-quality engineering, but also that her efforts would go unnoticed outside of the teamwork setting. By depending on her over-much for the team's engineering, by taking credit for her work outside the team, and by volunteering to perform public displays of engineering because "Pam had already done so much," Pete and Carson controlled both the team's resources and the public expression of the "team's" engineering. Though these practices, Pam was made invisible as an engineer outside the teamwork settings, especially in locations that came under the faculty's purview.

Marianne's real-world technical experiences exceeded her team mates' skills. She had not been employed in industry, but held on-campus jobs that gave her opportunities to put her mechanical engineering coursework to work. As the laboratory assistant to a professor doing preventive maintenance research, she understood real-world data-acquisition and control systems. At the team's regular meeting on September 26, she summarized the input of their client contact, Curtis (an engineering manager at Private Power), and a faculty consultant, Dr. Edison, for her teammates:

> *Mariannte: I think they're talking about two different things. The client [Curtis] is talking about new technologies. They [the manufacturing company] invested money to maintain this old equipment and then, when the new technology comes along they've got this perfect equipment that's completely outdated. So the cost [to upgrade] is that much more; they have to buy the new technology, plus they've spent all this money keeping up the cost. Dr. Edison is talking about PCs [personal computers], and sensors, and predicting when it [the equipment being monitored] will fail....*
>
> *For the work we're doing with hydraulics [in the lab where I'm one of the mechanical engineering professor's assistants], we have pressure sensors [that we monitor]. If you get a line that's crimped, that's going to cavitate a pump [a damaging condition], the PC [uses the data being acquired and] can shut the pump down. Then you go in and fix [the line that's crimped]. So Dr. Edison is talking about a situation where sensors know when to shut down [the equipment before the equipment gets damaged]....*

This led the team to propose a project that the students were interested in and that would fit into Private Power's operations (p. 5):

> *Martin: If we were to do a detailed load model, I see that as cut and dried. We'd pick one building and take the load off of it and then figure out what's coming out of here [the power plant]. Then you'd have that one building or that one group [in the manufacturing company's organization]....We would end up coming up with a system for that and then they could model that in these different places....*
>
> *Marianne: Yeah, but they have $200,000 set aside to reduce energy consumption at [the manufacturing company].*
>
> *Russell: Yeah and that would help Private Power know what [the manufacturing company] is taking and what energy is left.*
>
> *Karen: I like that a lot. I couldn't quite figure out why Private Power would be interested in reducing [the manufacturing company's] power consumption. But if they can reduce the power that [the manufacturing company] is taking at some lower price, then they could turn around and sell that [energy] to somebody else at a higher price. Obviously there's something in it for Private Power.*
>
> *Jessica: We could tie that into a PC [personal computer] control system. We'd be able to go in and monitor the fuel usage, the energy usage.*
>
> *Martin: What about a working model or a demonstration? Maybe not implement it, but we'd have a profile. Then we could know the next step is to implement this on each station or each area or whatever. Then we could get feedback.*

Marianne: We have all this equipment on the bench over in the department. We have a bus, and thermistors and PC's. It's all hooked into ethernet and we control a motor and control pressures off of the PC. So you know I've got that kind of stuff.

Individually and as a group, the Sludge Team students demonstrated their appreciation of Private Power's needs and students' capabilities. And in this typical Sludge Team meeting, women's comments about the team's engineering were taken seriously, not given extra scrutiny. These teammates trusted each other and worked together.

As the team proceeded along these lines, they found a road-block. At the direction of Curtis, Marianne called Ed, an engineering manager at [the manufacturing company], in early October to ask about getting access to a site to enact their load profile. Much to everyone's surprise, Ed (the manager) replied "Why would I want Private Power to have access to this part of our [manufacturing facility]?" The team was stunned and brainstormed how to get over this hurdle:

Nate: I'm surprised that Ed acted that way. Hey, if you can't get it out of him...

Marianne: Are you being sarcastic?

Nate: Oh no! If he wouldn't tell you, I don't know why he would tell anybody, because you're really good at this.

Though in-team gender relations were always respective, Marianne's and Nate's exchange was indicative of deeper-seated gender issues at PES. When Nate commented on Marianne's lack of success getting access to the manufacturing plant, she thought he was being "sarcastic," as if she were incapable of doing the work. This was not what Nate had intended. He genuinely believed that the team was in trouble because Marianne was "really good at" making these kind of contacts, locating resources, and gaining access. That Marianne jumped to the wrong conclusion gives some indication of her past experiences with other men colleagues at PES. The kinds of difficulties that Marianne described as "typical" were demonstrated in a whole-class meeting of the senior design course.

The Sexual Harassment Class

Class began about 12:02, all teams were present and students were very chatty. Six professors were present (Drs. Thomson, Austen, Norton, Stanley, Feinman, and Hawkes) and the guest speaker, a woman. I sat at a table with the Sludge Team. At about 12:04, Dr. Norton began class by standing up and saying: "Well, today our topic is sexual harassment and equal opportunity. The person who's going to talk about that is the Director of Student Services [a person, I refer to in dialogues as DOSS for brevity]." This discussion purposely not about white men was expropriated and served to maintain (white) men's historic practices, even clearly sexist practices. Though there were many indicators at PES that (white) men's perspective was taken as the perspective (and deemed appropriate to all persons), the Sexual Harassment Class created a hostile climate for women, in broad daylight, right under the noses of faculty and students who openly espoused women's full inclusion.

The Director of Student Services, a woman whose title and clothing (business suit, nylons, and

heels) suggested that she was an academic administrator, but not an engineer or professor, moved to the overhead projector in the front of the room and introduced her topic (Field notes, February 22):

> *DOSS: Well, today we're going to talk about affirmative action and sexual harassment. I'm not going to be giving legal advise. I'm not qualified for that. We're also not going to argue the philosophies behind it. I want to prepare you to enter the workplace. Public educational institutions and publicly-held corporations are required to meet federal laws in this area. On this campus, we have both of these policies in the [PES] Bulletin.*

Her decision not to "argue the philosophies behind" these legal codes set a bad precedent by failing to give students a stronger sense of the foundations for these laws. Based on what I had earlier heard students say, students that I knew well and thought would know about these matters possessed ill-defined notions of these ideas at best.

As the class progressed, the Director of Student Services read affirmative action guidelines to students and asked for examples of cases the students knew about. Even though affirmative action applies to several protected classes, the only example offered was about women's admission to a formerly all-male college - The Citadel. This gave the appearance that the salient threat came from women and contributed to a growing sense in this class that (white) men were under attack and must defend themselves from this threat. The battle lines were being drawn in terms of gender, while other groups were being overlooked.

The Director of Student Services continued her conversation with the students:

> *DOSS: What do you do if you're discriminated against? (A student calls out from the far corner in a loud voice.)*
>
> *Man student: SOOOO-EEE! (Whatever can he mean? He sounds like he's cheering on the University of Arkansas Razorbacks, as if he's calling pigs, an appropriate sound in that venue, but hardly appropriate in a college classroom. There is some snickering in his corner among the students, men I think. I am shocked by his outburst. As a regular member of the class, I am embarrassed by his behavior toward a guest speaker, who in previous classes had been men engineers who were treated with deference. What has happened to the manners these students usually possessed? The Director of Student Services ignores the manner in which he delivered his answer and concentrates on his implication that one <u>sues</u> the entity that discriminates against you on the basis of any of the protected classes.)*
>
> *DOSS: Yes. Corporations have procedures. It usually begins with an informal procedure. You meet with the director of human resources, and you negotiate and mediate. This is when you need good communications skills and assertive behavior, not aggressive, but assertive....You need to be aware of the policies, so you should read the policies. Now, let's turn our attention to sexual harassment. (She puts another overhead slide on the projector and reads each point. I include the numbers from the overhead slide.)*
>
> *That includes [1] unwelcome verbal advances, visual, physical contact, anything that's done that way as a condition of employment.*
>
> *And also, [it] includes [2] submission to or rejection of a complaint. That you get [harassing] treatment, that if you submitted to or rejected [harassing] treatment that could be used as a basis of employment conditions.*
>
> *Or that [3] the conduct interferes with your work and creates an intimidating, hostile*

environment.

Or that [4] a submission to or rejection of this sort of behavior [that] is used as a basis for decisions about you and your employment.

After soliciting a few personal experiences from students, the Director of Student Services deftly moved the conversation back to the definitions of sexual harassment:

DOSS: ...So there are two kinds of sexual harassment [tests]. First, there's the reasonable person test that someone would see it as a hostile environment. And in fact, there is, for these matters, there is a reasonable woman test, a reasonable man test. So it's something that a reasonable woman would find, because men and women do see things from different vantage points. The other one is quid pro quo. *Does anyone know what that one is?*

Man student: Well, I'll show you mine if you show me yours. (Again, I am shocked that he said this to a guest speaker. This strikes me as precisely the kind of semi-sexual comment that could be intimidating and make some people uncomfortable, as I am becoming. The Director of Student Services gently rebukes him.)

DOSS: Well, that's not exactly the way I would have put it, I would say, I scratch your back, you scratch mine, so there are conditions put on you by a supervisor. Here's the school policy on sexual harassment. It's lengthy. How many people knew it existed? (Almost everyone raises a hand.) How many people have read it? (Only the professors and I raise our hands. She makes no comments on that, but moves to a small-group activity wherein each team of students will discuss two case studies. After passing out the scenarios - one per table, she tells us to determine whether sexual harassment applies or not and to be prepared to explain our decision.)

Student teams throughout the room began to debate the first of two cases vigorously. Students were animated and talking loudly. Almost everyone was talking at the same time. Some of the debates become heated. This was very unusual classroom behavior for the once-a-week classes.

The second case study was about a female welder and her shipyard employer. In the workplace, there were pictures of nude and partially-clothed women, depicted in "gynecological" positions, and women engaged in various explicit sex acts. The woman filed a sexual harassment claim. The company argued 1) that if she did not like it, she could go someplace else, 2) that sexual harassment laws were not meant to bring about a magical transformation of the social mores of American workers, and 3) that the company's male employees possessed a right to freedom of expression. At my table, almost all of the students saw this example as clearly sexual harassment due to a hostile environment. Martin thought that the shipyard's strongest claim was the third one, which he called "free speech." He said he was not sure about this, but leaned in the shipyard's direction on that claim. Our discussion was interrupted by the Director of Student Services.

The Director of Student Services began to poll the teams, asking what we decided and why. Our team was one of the first ones called on and Marianne reported that we thought it was sexual harassment, because of a hostile climate. The team to our left went next. A man said that they agreed with the company; it was not sexual harassment. Then, working her way around the room, the Director of Student Services called on another team. A woman said that her team agreed with Marianne's team: "This is clearly sexual harassment, because it is a hostile environment."

At this point, the man who had just reported for his team stood up and continued to argue the perspective of the men shipyard employees. He placed his hands on the table, leaned toward the team that had agreed with Marianne, and glared at the woman who had just spoken. He justified his team's position because "this is the way things were before the woman arrived." The woman

student said nothing. One of the man's teammates (also a man) stood up and said roughly the same thing. In their words, "If they can't stand the heat, they should get out of the kitchen. That is the way it was and how come they [the men] can't keep doing this, just because she came in there?" Both of these men spoke in an angry tone of voice, accusingly.

None of the woman's teammates, who ostensibly agreed with her at some point, spoke up. Marianne, sitting next to me, was the only student who argued against the vocal men's position, saying "This is not fair. Why do I have to work in a place like that?" When they continued to repeat what they had said earlier, she rolled her eyes, and tsk-tsk'd, saying (to those of us sitting near her) "I can't believe it; these men [students] are so clueless." Amazingly, no other student took up the counter-argument, even though I knew there were three other students at our table (Jessica, Russell, and Nate) who opposed the shipyard's claims.

From across the room, Dr. Thomson, a man, yelled to be heard over the hubbub of the class, addressing his comments to the vocal men at the team next to me:

> *So, if you were a man and you were a welder, you would have access to this location for a job and you'd have other access as well. But you're going to constrain the woman's access? She's not going to be able to go to work here because of this environment? Why? Why is it that you [the men] get a different set of choices than she gets? That's not fair.*

The vocal men restated their earlier comments, several speaking at once. Dr. Thomson's line of reasoning was not successful in convincing those holding the shipyard's view. Without an appreciation of "fairness" claims, his argument came across as "just his opinion," which could be dismissed as "no stronger than another opinion," such as that represented in the talk of those few vocal men students. Another man student asked, "Why didn't she [the woman welder] just put up the other kind of pictures [pictures of men in the same sorts of inappropriate poses and clothing]?" Dr. Austen, a woman, replied, "Two wrongs don't make a right."

As time ran out in the class, the Director of Student Services summarized the outcome of the woman's litigation:

> *When this went to trial, the Florida District Court rejected the social context standard as perpetuating a pre-existing discriminatory environment and ruled that the workplace should be judged from the perspective of a reasonable woman. Also, [about] the free speech bit, [the court found] that this form of sexual harassment constitutes an exception to the first amendment, just like threats of violence, threats of blackmail, or fighting words are excluded from free speech. And the court ordered the company to adopt a sexual harassment policy and a general form [of a policy] proposed by the woman and her attorneys.*

While the Director of Student Services said this, there was a general buzz in the room from students. When she stopped talking, students at the tables began once again to debate the issue loudly. The bell rang and we left the room. As I walked into the hall outside the classroom, I heard men students still talking about the injustices suffered by male shipyard workers who "had to change the way they did things just because a woman welder was hired."

Both cases signaled that women's viewpoints matter, that women are a part of educational institutions (such as PES) and workplaces and have a say in how those communities are constituted. This was a point lost on many of the senior students.

Furthermore, the Sexual Harassment Class was no fluke. During her interview, Dr. Austen referred to these kinds of situations on campus, saying "there are...still some male students who exhibit the kinds of behavior that we saw the day we talked about sexual harassment in class."

Many senior students on the teams I followed closely also inferred that overt sexism was practiced in other classrooms, saying "like what happened that day in the Sexual Harassment Class."

The Sexual Harassment Class became not a place where understanding the legislation and clarifying court cases were valued, nor a place to learn how to comply with the laws, but instead a setting for hostility against women. That none of the students or professors successfully intervened, and most practiced a tacit tolerance, suggests how men's antagonism towards women's viewpoints became a regular feature of engineering education at PES.

PES STATUS HIERARCHY PRODUCES WOMEN'S INVISIBILITY

PES students' explanations of the organization of cultural identity categories celebrate two powerful, socially-constructed ideologies: academic prestige and gender status. The status divide between Over-Achievers and Nerds was reminiscent of Eckert's *Jocks and Burnouts* (1989). In her ethnographic study of social structure in an American high school, she demonstrated how the school institutionalized opposing class cultures which played out in student peer culture. Her Jocks were "middle class and college bound, played sports for the school, got respectable grades, and drank beer only on weekends" (p. 3). These students participated enthusiastically in the school, where extracurricular activities reinforced institutional goals and values. Through their participation, Jocks received the school's commendation and sponsorship. In opposition to Jocks, Burnouts "came from a working-class home, enrolled primarily in general and vocational courses, smoked tobacco and pot, took chemicals, drank beer and hard liquor, skipped classes, and may have had run-ins with the police" (p. 3). Burnouts rejected the school's values and goals, as well as felt alienated by the school.

Eckert's Jocks and Burnouts represent historically stable social categories within which individual students embody the oppositional relations of a (white) American class system. Most students at PES, as nose-to-the-grindstone students taking every college-prep math and science class available, would have been among Eckert's Jocks in high school, but PES students arrived at college to find a different institutionalized status system. At PES, Over-Achievers (both Academic-Achievers and Greeks) represent students who accepted and adhered to post-secondary, academic institutional values and interests; Nerds more-closely align with those values and interests affiliated with "actual" engineering[3].

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[3] By "actual" engineering I mean the complex kinds of activities common to everyday, practical engineering - applying engineering principles, while taking into account other non-technical factors, such as economics, environmental concerns, the interests of the general public, and the in-house preferences of industry clients. As a former engineer, I recognized that "actual" engineering was the "real McCoy" of engineering practice in careers. Thus, "actual" engineering requires a working knowledge of the engineering principles taught in conventional engineering and science courses, and does not imply that "actual" engineers do not possess "academic" engineering prowess. In contrast, "academic" engineering refers to those skills needed to do well in academic courses, without demonstrating an ability to apply these engineering and scientific principles to real-world projects or to take non-

In addition, Eckert's school highlighted how the Jocks' contributions to their school and launched them into the kinds of futures most valued by teachers and school administrators, while the contributions of Burnouts were largely ignored. This turned out to be the case at PES as well, where the organization of the PES campus framed the success of Over-Achievers. While Over-Achievers basked in the spotlight, the contributions of Nerds were downplayed and of women made invisible.

As implicit markers of belonging in an engineering-education system, engineering-student cultural-identity categories codified an academic-prestige ideology. The most powerful students (Over-Achievers) lived up to academic expectations, not those of engineers employed in industry. Over-Achievers came to the notice of the campus administration and faculty, participated in "running" the campus via participation in campus-wide committees, garnered financial and meritorious on-campus awards, had the most on-campus job interviews, went on the most plant trips (a job-site interview that is part of the courting rituals between industry and student engineers), received the most job offers, took the best jobs, and were courted by graduate schools. Being an Over-Achiever indicated a person who made fewer contributions to the team and whose social commitments and participation on campus-wide committees came before their design-class teamwork.

The learning and knowledge systems associated with Over-Achiever and Nerd categories were quite different one from the other. Over-Achievers were most comfortable with learning in conventional academic courses where professors "delivered" knowledge abstracted from the real world, encoded in scientific equations, and exemplified by textbook exercises and timed tests requiring rapid-fire responses of a drill-and-practice nature (as opposed to a reflective or thoughtful nature). High-status student engineers placed most of their effort on satisfying faculty demands. Those who "over-achieve" fulfilled academic institutions' definitions of success and were anointed with prestige, status, and well-paying jobs in return. Yet, this recognition did not necessarily connote engineering capability of the sort expected by industry (Dutson, Todd, Magleby, & Sorenson, 1997). While Nerds performed the vast majority of technical, scientific, and engineering work, Over-Achievers gravitated toward non-technical "public performance" tasks, such as giving oral presentations and writing reports, that part of the teamwork on display for the benefit of other teams, faculty, and clients.

The lower-status Nerds were successful in conventional academic settings, and were academically successfully, but not overly so. In contrast to Over-Achievers, Nerds had sparser academic pedigrees and, on paper, appeared to be less qualified than Academic-Achievers and to have fewer social networks than Greeks. Nerds do not regularly come to the attention of faculty

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technical concerns into account.

and administration. Nerds placed more emphasis (than Over-Achievers) on understanding how abstract equations represented or modeled real-world situations. They could "see" the concrete, physical world in terms of scientific and engineering principles and equations. They also incorporated considerably more reflection into their engineering work, such as being concerned with the impact of a plant or process on the environment, the general public, and economic viability. Design projects were especially rich environments for the kinds of activities that Nerds preferred. In the senior-design teamwork, Nerds contributed substantially more to their teams' successful completion of their clients' projects. Nerds plugged away, engaging in just enough socializing and entertainment to survive the academic rigors and "have a life," while Over-Achievers dodged their share of the work, avoided becoming involved, and developed arguments for both staying on the margins of the team's work and working in isolation from other team members which they justified as "more efficient."

Women's identities were singularly different from those of men. Except for the contentious term, PES-woman, the Greek scene was the only cultural identity category where explicitly female-marked terms existed.

Academic Prestige: Code for Women's Subordinate Status in Academic-Science Communities

Margaret Rossiter alludes to the historical roots, and co-construction of, academic-prestige and gender-status ideologies in U.S. academic-science communities. In addition, I borrow from the work of Dorothy Holland and Margaret Eisenhart who delineate the contributions of college peers to the construction of women's subordinate status. I argue that PES engineering-student cultural identity categories represent identities historically developed to define a (white, heterosexual) male scientific community and that PES orders students' academic lives to maintain these cultural identities.

Rossiter recently published her second book devoted to a thorough historical analysis of women scientists' plights in the U. S. (*Women Scientists in America: Before Affirmative Action 1940-1972*). The historical message is clear; even in the post-war era when unprecedented growth in technology fields occurred and extraordinary efforts were made to recruit capable individuals, women were systematically cut out of the picture. One cannot read Rossiter and fail to understand the horrifying consequences of a "prestige" principle which, when linked to gender status, reduced women's numbers and power in every facet of scientific work except non-profit institutions and self-employment.

Though she did not present a prestige theory per se, Rossiter's descriptions of academic life in the three post-war decades outline the extent to which "prestige" on academic campuses was code for reducing the numbers and influence of women faculty members, for reducing teaching loads and increasing research expectations (which benefited men), and for hiring more Ph.D.'s (usually men). During this period, woman and areas of study considered "women's work" were

under attack as never before, all in the name of "prestige." Changes to four arenas of academic life, during the period 1940-1972, contributed to the defeminization of academia: graduate schools, faculty, home economics and teaching, and women's colleges.

First, at graduate schools, deans "were convinced that a high dropout rate was a sign of high standards and were utterly opposed to such arrangements as part-time study or childcare as *unbecoming* of 'serious' students at prestigious universities" (Rossiter, 1995, p. 65, emphasis added). Refusing to take seriously those needs most apparent in women graduate students, deans guaranteed that women carried extra burdens, burdens that men rarely experienced, and ultimately reverted to blaming women who dropped out, claiming that women were not up to snuff academically. By equating "the need to keep up the value of the doctorate" with "full-time study," "[deans] took for granted the usual circumstances of most (white) men graduate students" (p. 65) and spoke a rhetoric of "prestige" that cloaked sexism.

Second, women's presence on university faculties and women's influence there suffered due to "prestige" claims. Despite the government's predictions of impending "manpower" shortages in the sciences, "faculty women remained very rare at prestigious institutions" (Rossiter, 1995, p. 125). Those few women faculty employed came under fierce attack when colleges and universities began upgrading. "Increased resources could and did unleash ambitions and provided the means to undercut women's niches and masculinize academia to record levels" (p. 126). Women simply were not hired at prestigious universities. When they held academic jobs, women "taught more, published less, were paid less, and were honored less than men" (p. 147). When a college saw itself as prestigious, it hired men; when a college had more women faculty (relatively more, not many), it was considered less prestigious.

Third, areas of study historically deemed "women's work" - especially home economics and teaching - were eliminated, subsumed (and colonized by men) in other male-dominated academic realms, and forcibly changed to fit male-identified notions of academic study. Home economics was under attack because of a "growing sense of embarrassment, usually at prestige-conscious universities, about the field's strong vocationalism or explicit links to teacher education...and the low proportions of doctorates among its faculty" (p. 165). While encouraging women to publish more research without supporting these tasks with institutional resources, deans exonerated their preference for men faculty and the removal of women. Through these means, "home economics, once a female subject, taught for decades by women faculty to women students" became a site for the "more traditional and comfortable 'hierarchical segregation'" of academia (p. 185). Teachers colleges suffered a similar fate. Claiming to desire more prestige, administrators and trustees reduced the numbers of women, while increasing men's numbers.

Fourth, in frightening proportions, similar "upgrading" occurred at women's colleges. These were often related to liberal arts colleges' claims that to be competitive with industry and

universities required higher faculty salaries. In fact, "higher salaries were only necessary if one wished to hire men with families and provide the proper fringe benefits" (p. 225). Since vast numbers of qualified women would take a lower-paying job, the "competitive-salaries" rhetoric was a "code phrase for mainstreaming and consequent masculinization of the women's college faculty" (p. 225). Smith College (through the writings of a former dean) touted itself as "the best women's college...because it had the most men on the faculty!" (p. 227). That women's colleges, with their historic devotion to women's education, were swept up in the post-war "prestige" rhetoric demonstrates the intensity of the defeminization of academia.

In these four academic-science areas - graduate schools, faculty, home economics and teachers colleges, and women's colleges; post-secondary academic prestige was cultural code for justifying the reduction of women's numbers and influence, as well as for forcibly changing historically "women's work" to fit men's perceptions of appropriate academic endeavors. In the post-war academic-sciences, academic prestige entailed - produced and maintained - men's privilege. This is the case at present-day PES.

Because of the decontextualized nature of Rossiter's historical research, I turned to Holland and Eisenhart (1990) to guide finding academic prestige and gender status in face-to-face interactions of the sort I studied at PES. They found that women's status was mediated by college peer groups. In their 1990 book, *Educated in Romance: Women, Achievement, and College Culture,* Dorothy Holland and Margaret Eisenhart detailed the ways that college students "learned gender" from their peers during extra-curricular, peer-group interactions. Women's social worth in the peer culture was subordinate to men's and determined differently than men's:

> Even though men and women paired up according to an equivalent level of attractiveness, and though women and men exchanged tangibles and intangibles of equal value, their relations turned out to be unequal. They were unequal because women's attractiveness - and in some sense, social worth - was a function of their appeal to men, whereas men's attractiveness and social worth were reckoned according to their appeal to women *and* their success in sports, music, business, and other fields (pp. 211-212, emphasis theirs).

Though men gained in esteem by participating in a wider campus community, women did not. Students' status in the peer culture was a regular feature of college cultural life and removed from the control of individuals.

Holland and Eisenhart studied two southern universities. One was predominantly black and the other white. Their assessment of peer culture as the site for "learning gender" was true of both colleges and, through comparisons of studies performed at universities in other regions of the U.S., relevant to a large number of post-secondary educational institutions. They followed the academic lives of women with strong academic records and high career aspirations. Though half of the sample expected to major in math- or science-related fields, and the other half were strong students in a variety of other fields, Holland and Eisenhart watched as these young women moved

into traditionally-female, lower-status positions in society. Only a third of the women met their pre-college aspirations.

Holland and Eisenhart explained their disheartening results as a result of students learning gender in peer groups via a culture of romance. They found that "agemates were more virulent purveyors of gender privilege than school authorities and school materials" (p. 8). However, I document a far-more-systemic, educationally-institutionalized subordination of women on the PES campus. Women's absence from the PES cultural-identity categories signals women's absence from culturally-appropriate, engineering-student ways of life. Thus, while men enacted culturally-sanctioned ways of being engineers during teamwork and classroom participation that was reinforced in the curricular structures, interactional routines, and kinds of learning and knowledge, women had no culturally-accepted ways to be *recognized* as engineers. Women's "invisibility" was produced in the everyday engineering practices on campus.

Constructing Gender Status at PES Via Cultural Identities and Design Work

Women's subordination to men at PES was systemic, ranging across student-student interactions, teamwork, classes, the curriculum, and the campus administration. Taken together men's and women's circumstances show how the prevailing system worked to erase women, to make them invisible. This should not be taken to indicate that women felt the pressure of a system and decided to move on, either to the margins or out of engineering. Quite the contrary. The prevailing system took men's perspectives for granted, denied that women's perspectives are (or could be) different, and *systematically* failed to "see" women. In other words, women were *made invisible* to this system. And, as corroborated by the survey, women at PES (not just those that I knew well) saw the curriculum, the nature of engineering problems, the faculty, and the value of design and conventional courses for engineering careers in different ways than men (Tonso, 1997).

Classrooms practiced women's invisibility. Though genuinely motivated to make their classrooms places where women were welcome, PES faculty fell into accepted (at PES) practices that undercut these goals. For example, as part of a larger sameness ruse at PES, the professor of the first-year design class assumed women's preparation for technical drawing equaled men's. Had he gathered information on their preparation, he would have found that women, as a group, were substantially less likely to have as much technical-drawing experience as their men colleagues (Tonso, 1997). By presuming to know women's experiences and needs, he illustrated how a predominately male-identified faculty managed to privilege men's perspectives over women's in spite of good intentions. Actual flesh-and-blood women were made invisible through his actions.

Some teamwork settings became sites for women's mistreatment (Tonso, 1996a,c, 1997). For instance, on one of the senior teams, two men students (Pete and Carson) treated one of their women colleagues (Pam) unfairly. On this team, students acted as if all were performing

engineering calculations on their own, then arriving at the weekly team meetings where all students shared their progress. However, it became the custom for Pam to perform most of the out-of-team engineering calculations, meaning that the only engineering to be shared at team meetings was Pam's work. Carson, an Academic Over-Achiever concerned with his own grade-point average, used these opportunities to grill Pam. Because he was a mechanical engineer and lacked even the most basic appreciation of Pam's chemical engineering expertise, he was ill-prepared to make judgments about her work and expected Pam to educate him on demand. He called this "being a devil's advocate;" it was academic hazing. Though none of her colleagues took Carson to task for his heavy-handed approach, Pam routinely chastised him for his behaviors and suggested that his time would be better spent performing the mechanical engineering he continually promised, but never delivered.

Pete's mistreatment of Pam took a different form. He was a hard-core over-achiever who bordered on being a brown-noser. He used the team meetings to assert his "leadership" and advocate not meeting as a valid kind of teamwork, while never performing anything resembling engineering. Over the course of two semesters, I saw no evidence that he could do engineering. When his teammates told me about his stratospheric grade-point average, I thought they were pulling my leg. However, when design-course requirements mandated an oral presentation or formal written report, Pete made sure that he controlled these "public performances." Since he knew little about the team's project or their progress completing it, he used these opportunities to require that Pam explain things to him, information which he trotted out on stage for his audience. He thought that he was doing his share of the design work; he was exploiting Pam.

With only limited, on-campus support for engaging in discussions about the inequities she faced, Pam was left to her own devices. She navigated the teamwork social space, which manifested her day-to-day exploitation and hazing, without ever losing sight of the extent to which the team's rhetoric about doing "actual" engineering failed to match the team's actions. Though her skill performing "actual" engineering remained hidden from those outside the team, she was otherwise a persistent reminder of women's presence. Nonetheless no one seemed concerned that she had to go it alone in these teamwork settings, a well-publicized fact of life for many women engineers and student engineers (e.g., Agogino & Linn, 1992; Tonso, 1996a,c). By assuming students treated their teammates ethically and that all students had an equal say in teamwork, PES practices, as reinforced by the curriculum, faculty, and traditions, turned a blind eye to the realities of women's diminished status in some teams. More-equitable teamwork practices remained hidden from the view of institutional practices and could not directly contribute to changing them.

In addition, some classrooms became sites for women's mistreatment (Tonso 1996a,c, 1997). It is especially noteworthy that I saw nothing of this sort in the first-year-design classrooms. Sadly, hostile climates existed at times in both the sophomore (Tonso, 1993, in

press) and in senior design classrooms (Tonso, 1997). Thus, classroom culture and women's place there develops over time as students learn their cultural identities through PES engineering education practice. For example, in the senior design classroom, one 50-minute class period focused on affirmative action and sexual harassment. Rather than being a safe place where students engaged in developing an understanding of these two legislative responses to racism and sexism, the classroom became an example of a hostile environment for women - one of two legal definitions of sexual harassment. A guest lecturer, the Director of Student Services, was guiding the students through the second of two sexual-harassment case studies when a few men began to argue vehemently against women's having a say in workplaces. By aggressive physical stances, especially standing and leaning in the direction of women students with an opposing view, and by confrontational discourse styles, such as yelling their sexist opinions repeatedly, a small - but vocal - minority of men students controlled classroom discourse and practiced a virulent form of sexism. One woman student and one man engineering professor spoke against these vocal men students, but were shouted down. Other students and faculty, several that I knew well enough to anticipate their disagreement with the vocal minority, did not confront their sexist classmates.

When I asked senior students about the Sexual Harassment Class, they expressed disgust and resignation at the actions of the vocal minority. However, only one gave an explanation of why no one "noticed" the mistreatment of women. He said:

> It's almost like, because there's that sense of, you know, everyone wants to make sure that we're all equal engineers. When you start talking about sexual harassment that says, 'Well, wait a minute; that treatment implies that we're not all equal.' The people say, 'Well, we don't want to admit that, you know, because we are [so used to thinking of men and women students here as equal].' I think that's the biggest thing. (Nate, 4-4, p. 15)

This lopsided logic of equality, a myth that *asserts* "we're all equal" and from this concludes "there's no inequality," signals a key way that students and faculty enact culturally-sanctioned practices. Nate helps us understand how, at PES, learning to take for granted that men and women students are equal, as opposed to noticing what is going on around them, keeps women's circumstances invisible. Not noticing becomes a way of demonstrating membership in the community. And the men who practiced this virulent form of sexism congregated in high-status cultural-identity locations.

Linking Anti-Woman Hostilities to Cultural Identities

PES engineering education sorts students into an academic hierarchy. Rather than being organized along social class lines, as Eckert (1989) documented, PES is organized along academic-science and gender lines. Only two of the twelve men I knew well demonstrated hostilities toward women - Pete and Carson. Showing that these men who practiced virulent sexism were located among the high-status cultural identities suggests how PES engineering education (as a kind of academic science) promotes women's subordination. Let us begin with the first-year men and then

discuss seniors.

None of the men first-year students exhibited hostilities toward women. They treated their women colleagues with respect and took their needs, interests, and experiences into account in their teamwork. However, because their cultural identities were not sufficiently formed to observe, I can only guess about these men's ultimate locations in the cultural identity terrain.

Most senior men students did not exhibit anti-woman behaviors. Three of these men were considered (by their teammates) to have desirable Over-Achiever identities (fraternity man, fraternity brother, studious, hard-working, leader, over-achiever), but none combined success on campus with overt sexism in their relationships with women. Their comments about, and interactions with, women were always respectful.

This was also the case among Nerds that I knew. They were less affiliated with the academic-success hierarchy, but nonetheless aware of it and responsive to it. All five of these senior men students held their women colleagues in high esteem, took them seriously, and treated them with respect. There was no hint of overt sexism in these five men's interactions with women. In fact, on the senior team where all of the men students (Nerds and Over-Achievers) respected women, men promoted women's interests openly, while on Pete and Carson's team no one promoted women's interests.

In marked contrast, Carson and Pete were differentiated by their willingness to place their academic success ahead of consideration for others. Both men had extraordinarily strong commitments to the academic-prestige hierarchy on the campus. In the case of Pete, one faculty member remarked that Pete was "viciously not collaborative [and] would stab his mother if it would help him keep his [high grade-point average]" (Field notes, 8-24-95, p. 1). Carson's peers thought of him in similar, though less egregious, terms. Pete exploited Pam; Carson hazed her - different, but both highly inappropriate, ways to relate to women engineering colleagues. In addition, they were the only men who gave sophisticated myths about "reverse" discrimination to support their perceptions that women students had special advantages, in spite of the fact that the PES placement office reported that women graduates did not get better jobs, more pay, or higher grades than men. Clearly these two men practiced sexism routinely. Their locations among the "went-too-far" Academic-Achievers - hard-core over-achiever, brown-noser, and anal - carried with it a disregard for others that included sexism toward women colleagues. Pete and Carson, as exemplars of those student engineers most highly rewarded for their academic prowess and as the only men who practiced overt sexism, represent the clearest evidence of the way academic prestige (as socially constructed and supported by the institution) structured women's subordination.

A few Greek identities also carried an expectation of men's sexist treatment of women and these were in the "went-too-far" social locations. In particular, students' descriptions of jock, BMOC, frat boy, and frat guy cultural identities implied that men fitting into these identities

engaged in systematically demeaning women. Marianne, a woman on a senior team, told a story about her experiences attending a fraternity party in her first year where she was asked to write her name, age, and phone number in their "little books." She decided that a sex object was the only perception of woman these men held. None of my men senior students fit into these locations in the identity terrain.

Nonetheless, men with high-prestige, Over-Achiever cultural identities located in the areas where student engineers "went too far," either as Greeks (jock, BMOC, frat guy, frat boy) or as Academic-Achievers (hard-core over-achiever, brown-noser, anal), incorporated substantially more anti-woman behaviors than other engineering-student cultural identities. These "went-too-far" men Greeks exhibited their personal force over (or sexual exploitation of) women, while men in the "went-too-far" men Academic-Achievers personified a sexism that flowed with exploiting others and protecting the status conferred by the campus on Academic-Achievers.

As was the case during the Sexual Harassment Class, only a few men demonstrated anti-woman hostilities at PES. And the inaction or lack of a vigorous rebuttal against the anti-woman line of reasoning illustrates how silence became a culturally-appropriate response to sexism (similar to what Stein reported, 1995). In other words, PES engineering education encourages, through cultural supports, a small minority of men student engineers whose cultural identities are not only aligned with academic science, but also embody substantial anti-woman bias. This small minority wields power that reinforces a *status quo* that is both pro-academic-science and anti-woman.

Though many students noticed this "in-your-face" sexism, no one recognized the more-pervasive, deeply embedded, axiomatic, taken-for-granted privileging of men that flows with women's absence from the culturally-sanctioned ways of *being* engineers.

Campus-Wide Evidence of Women's Invisibility

The exclusion of women's needs, interests, and perspectives extended campus-wide and included ways PES administration handled rape statistics, as well as how men faculty talked about their women colleagues. Though I had not expected that rape would become a part of my research since my access was in classrooms and team meetings, rape surfaced in conversations with faculty and students. The first comments came from women faculty during early conversations on campus. As women faculty became familiar with my research goals, they made unsolicited comments about a problem with rape on campus. When I asked about their reasons for this concern, they replied that this was just a gut hunch, not something that they had specific information about. Since I had not expected to research rapes on campus, I did not pursue their comments further.

Later, the campus newspaper published a story stating that no rapes had been reported on campus in the last few years. Taking that information at face value, the administration announced that "no reports of rapes" meant that no rapes had occurred, a claim some students refuted. My

senior students had been on campus during the years when no rapes had been reported and, after reading the article, told me the interpretation was wrong; women had been raped, but those were not reported. One sorority organized a rape-awareness workshop. Jessica, an officer of that sorority, told me more about why they sponsored the workshop (Interview, 4-12, pp. 4-5):

> Our sorority has talked about [rape],...because some of my sisters have, unfortunately, encountered situations along those lines. We've talked to Dean [of students] and the campus police about them, trying to change the bulletin, or the [newspaper]. [It] tells how many, quote, unquote, rape cases there are. A lot of times it's zero, which leads females and their parents to think that PES is a rather safe campus and it's not as safe as they'd like it to be....
>
> Plus, there's got to be some interaction. It's not just something for the females to be aware of. I think it's one of those issues that men need to be aware of too. It's not just females need to know how to say no; the guys need to not put the women in those situations, as well.

After hearing her say that the official position at PES seemed to downplay on-campus rapes, especially giving parents a sense that the campus was safe, I asked Pete, Shane, and Russell about the tours they gave to prospective students and their parents. These young men reported that their training included suggestions to tell the parents of women applicants that this campus was safer than a college of engineering at a nearby university where rapes had been reported.

Many of the senior students I knew well had no explanation for why women did not report rapes. Nate talked around why this might be the case (Interview, 4-4, p. 15):

> *Nate: There was a rape, I think, two weeks ago.*
>
> *Karen: Oh, really?*
>
> *Nate: Well, I don't even know if it got reported. The reason I heard about it [was that] I saw it in the paper (he trails off). I happened to go to a [campus] paper meeting that week....Somebody said "Well, is that going to cover the rape?" I was like "What?!!" (Spoken with astonishment.) I guess there was a rape the night before and I don't know if it got reported [to campus authorities]. I didn't even see an article on it either. I don't know if anybody wrote anything on it.*

The campus newspaper seemed to play along with the custom by not reporting allegations of rape. It seems inconceivable to me that anyone could believe there had been no rapes on a college campus where men outnumber women by a large margin and where drinking is practically an indoor sport. Concerns about personal safety and reputation (and probably about maintaining community membership) kept women's issues out of sight.

Jessica's story about her sorority's response to on-campus rapes was my only evidence of women banding together to address women's concerns. Unlike Willis' "lads" and Eckert's Burnouts, but like Holland and Eisenhart's women college students, women students at PES did not form alliances with other women to counter sexist practices. Though Karla (a first-year non-traditional student) and Marianne (a fourth-year traditional student) spoke with me about their problems with exclusionary practices on a few occasions, neither had another forum on campus

where their "take" on campus life was discussed. By contrast, Jessica (fourth-year traditional student) found allies only in her sorority where some issues concerning women were discussed, in spite of the fact that she explained her fit with engineering as emerging from her childhood and related to the fact that she never played with girls only with boys. Distancing herself from girls and women to explain her fit with engineering, but using a traditionally college-female route to form alliances with other women, encapsulates the sort of contradictory strategies women use to persist in engineering.

Further evidence that may suggest why women students do not band together came from my interview with Dr. Austen. We were in her office with the door into the hall open for ventilation. As we talked about what it was like for her on campus, she described the way women faculty were treated by their colleagues (3-25, p. 8-9):

> *Karen: So do you think it's different to be a man faculty member on this campus than it is for a woman?*
>
> *Dr. Austen: I suppose so, you know. There are still the stories that you hear about big decisions being made in the locker room at PES, or whatever. I think it's kind of funny. We had a faculty forum last week and about six women faculty ended up sitting together in the front row. The people took notice. I think that if you get more than two women together it's a conspiracy of some kind, plotting something, you know....I think math and engineering are still pretty much male clubs and most of the males don't even realize how clubbie they are.*

A faculty colleague sticks his head in the door and the three of us exchange pleasantries. Imagine my surprise when he accuses us of "conspiring," which I captured in my audio-taped interview:

> *Dr. Anthony: Are you guys plotting something real dastardly?*
>
> *Karen: You bet. Definitely.*
>
> *Dr. Austen: Very dastardly.*
>
> *Karen: Oh, absolutely dastardly. (He walks on down the hall and I returned to the next interview question as if nothing had happened.)*

Women talking together were distrusted at PES. Dr. Anthony displayed the culturally-sanctioned disapproval of women who collaborated on the campus, or might be collaborating, without noticing that this delivered a message that women do not belong and cannot participate as legitimate members of the community.

Dr. Austen's awareness of culturally-sanctioned behaviors and the conflict that comes from her sense of herself as a member of the community, someone who enacts culturally-appropriate practices, begins to illuminate how gender status became a two-edged sword for women. If women comply, then sexism goes unchecked. If women disrupt sexism, then anti-woman activities escalate in ways that promote sexist practices. Some would say that women contribute to their own subordination (analogous to Willis' lads, 1977), but I think this seriously underestimates

the extent to which women's safety depends on their acting as if they do not notice their subordination.

For women students and to some extent women faculty as well, buying into the rhetoric of engineering's rewards (within which women were in actuality subordinated) ultimately reinforced their own exclusion from the kind of participation that would take them seriously. That is, by minimizing female-salient aspects of women's appearance, social interactions, needs, and interests, women reinforced the exclusion of womanhood; just as speaking out or displaying women's needs and interests demonstrated their not being engineers. (See Tonso, 1996e, for more details.) Women expected a hostile climate on campus and learned how to navigate these shark-infested waters, because there were neither efforts made by the campus to provide safe places for women to air concerns, nor to take women's concerns seriously in the PES organization. By and large, women were expected to go-it-alone, a curious nod to the sort of individualism expected by the academic-prestige ideology. According to the prevailing illogical system of meanings, to be "engineer" is to be "not-woman," while having women's needs and interests means one does not belong, cannot belong, in engineering. To become an engineer at PES means that women must conceal being a woman; that is, they must act like men.

Women student engineers made minute-to-minute decisions, mediated by the campus culture, that demonstrated their determination to fit within the engineering community and these decisions, over time, contributed to the perpetuation of a community that is profoundly unfair to women. However, characterizing these constrained actions as *producing* women's subordination risks overlooking the extent to which women's strategic decisions keep them safe in an incredibly hostile climate. I have no stomach for suggesting that women speak out and subject themselves to even more mistreatment. The far larger contribution to women's extreme subordination in the PES engineering community came from the anti-woman nature of the campus culture. Because it is a *cultural* climate, individuals from a historically subordinated group, such as women, have only limited power to transform this culture. This gives the lie to blithe notions of "agency" and "autonomous choice" that do not account for cultural circumstances.

Consequences of the Absence of Women's Cultural Identities at PES

Engineering has long been perceived as a place where women "become one of the guys," but the almost total exclusion of women from the cultural-identity terrain illustrates that "becoming one of the guys" is a euphemism for making women invisible, not a kind of belonging that women engage. Without meaningful identities to represent women's rightful place among student engineers, the culture does not (and cannot) take women seriously as engineers. Women student engineers who "over-achieved" had only one cultural identity - sorority woman - to engage and its over-socializing, prototypically-"feminine" connotations made it unattractive for many women. Women student engineers who should have belonged in the Nerd-dom landscape were consigned

to the term "PES-woman." This tells us about how engineering thinks of women who do "actual" engineering, not about women who practice "actual" engineering. It bears repeating that women, like their male counterparts, are remarkably diverse and yet, engineering education at PES cannot "see" them - either as Academic-Achievers or as Nerds. This is crucial to understanding the construction of women as outsiders.

Without cultural identities for women engineers, "belonging" was illusory. That is, lacking ways to think of women as belonging, flesh-and-blood women were made invisible at PES. The circumstances of pairs of senior women students (Carol and Jessica, Pam and Marianne) illustrate the impact of not having cultural identities that conjoin woman with "academic" or "actual" engineer. On the one hand, Jessica was a sorority woman (active in the campus social scene and receiving good grades) and Carol exemplified the detachment of the loner who earned good grades, ostensibly fitting into the realm of studious, hard-working students. On the other hand, Pam and Marianne did not affiliate with the prevailing notions of academic prestige and, though both had GPAs above 3.0, neither came to the notice of the campus status system or fit industry expectations of new-hire engineers. These circumstances provide evidence of the central importance of cultural identities to mediate belonging.

Nell Painter (1992) and Kimberlé Crenshaw (1992) suggest ways to think about how engineering's cultural identities contributed to the plights of Pam and Marianne. As Black women scholars, Painter and Crenshaw studied social constructions of race and gender flowing from and through Anita Hill's testimony against Clarence Thomas during hearings on his appointment to the U.S. Supreme Court. Painter and Crenshaw recognized that racial and gender stereotypes were used as narrative tropes and metaphors for identity, and framed arguments advanced by both Hill and Thomas:

> Thomas appropriated the figure of the lynch victim despite glaring dissimilarities between himself and the thousands of poor unfortunates who, unprotected by white patrons in the White House or the United States Senate or by the law, perished at the hands of white Southern mobs. As though education, status, and connections, counted for nothing. (Painter, p. 208)

"Thomas worked the pitiable image of the victimized [B]lack man...[and] his exploitation of the imagery of race succeeded" (Painter, p. 205).

Painter and Crenshaw describe the "roles" this left open to Anita Hill after Thomas cast himself in the guise of lynch-mob victim. Painter points out that as a Black woman, there were few roles for Hill to play in the race drama: "Mammy, welfare cheat, Jezebel period. These were the roles available to Anita Hill. Hill chose not to make herself into a symbol Americans could recognize, and as a result, she seemed to disappear..." (p. 210). With no way to understand her as a Black woman, Hill's place in the drama became cast as a certain kind of White woman and this left her no room to maneuver. Crenshaw found that Anita Hill, "...a Black woman, herself a

victim of racism, was systematically transformed into the role of a would-be white woman whose unwarranted finger-pointing whetted the appetites of a racist lynch mob" (Crenshaw, p. 403). As a woman, even an archetypal white woman, Hill's testimony was dismissed.

> Ideology, seen in the form of the narrative tropes available for representing an experience, was a factor of social power to the extent that Anita Hill's inability to be heard outside the rhetorical structures within which cultural power has been organized and [this ultimately] hampered her ability to achieve recognition and support. (Crenshaw, p. 403)

With this framing of the Hill-Thomas confrontation, both "actors" were perceived according to pre-existing archetypes for women (white and of color) and men of color in our society. That is, Hill and Thomas were interpreted (their actions given meaning) according to deep gender and racial grooves built into the "common sense" of our society.

[Add Eisenhart and Lawrence here]

Though the salient features of the PES engineering education community differed markedly from the circumstances of the Hill-Thomas clash[4], deep grooves of a gendered nature are built into PES engineering education, grooves that are made evident through cultural identities. The cultural power of engineering-student cultural identities is on a par with the force of stereotypes faced by Anita Hill. Women engineers were discounted at PES by the absence of culturally-sanctioned images through which to interpret, to make meaning of, to recognize, or to characterize either women or women's engineering practices. In framing her own cultural identity, Hill rejected Mammy, welfare cheat, and Jezebel; Pam and Marianne rejected sorority woman, sorority chick, sorority girl, betty, and PES-woman; four of which were pejorative stereotypes and the fifth the embodiment of woman's subordinate position to powerful men in a normatively heterosexual society. Without cultural frames of reference matched to their realities, Pam and Marianne "seemed to disappear" from the cultural landscape in spite of their considerable skill practicing "actual" engineering.

Though *engineering* ostensibly differs from the "academic sciences" in several ways at PES, the most-valued kinds of activities, those that return the most prestige to their practitioners, are extremely close to the abstracted-from-the-real-world science preferred by academic sciences. In promoting this version of "science" over the kind of science practiced in "actual" engineering, PES elevated practitioners of academic science, especially those who were willing to succeed at the expense of others, over other student engineers. Because women had been almost completely erased from the cultural identity terrain, they could engage very little of the power necessary to operate the academic-prestige machinery. That is, women could not shape actions in the ways of engineering to the same extent as their men colleagues. Thus, women's actions in the system were

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[4] Though women's situation in engineering is far from ideal, I do not mean to imply that it is on the order of oppression of Blacks in our society. Racial injustice is far worse and women of color are subordinated in our society to a greater extent than (White) women student engineers.

systematically disempowered relative to men, especially when compared to those men who held the highest power (such as Pete and Carson).

This was the case both for women "academic" and "actual" engineers. Women who demonstrated robust "academic" engineering practices found no cultural identities among the went-too-far Over-Achievers. Thus, women "academic" engineers could not belong in the higher-status locations and could not engage the power available to Pete and Carson. Jessica inhabited the only cultural identity terrain open to women at PES that did not embody pejorative stereotypes of women, and Carol melted into the background as a quiet, hard-working engineer. They made it through the gauntlet of PES engineering education and into engineering jobs. However, these two women personify the kinds of women McIlwee and Robinson followed into engineering careers. Both were good at math and science in high school, survived in college using these skills, and did not acquire the hands-on, real-world practice inferred by "tinkering" skills that often mark men as belonging in engineering. Their experiences in engineering careers will depend (according to McIlwee and Robinson) on the extent to which engineers hold power in their worksites, something I suspect neither of them took into account when seeking a job.

Similarly, women "actual" engineers found no cultural identities among Nerds. This reduced their being thought of as belonging in the community and precluded their engaging even the discounted power (relative to Over-Achievers) available to (men) Nerds. Pam and Marianne provide clear evidence of the consequences of being a woman and having the kinds of skills to connect academic coursework to real-world projects that is valued in men. Though both exhibited marvelous engineering skills, neither had a job when she graduated. On the one hand, performing "actual" engineering contributed to their being invisible and, on the other hand, being women kept them that way.

Perpetuating Sexist Power

Think back to the ISD Sexual Harassment class. The classroom began to come apart at the seams when student teams discussed the case study of a woman welder who filed suit because of sexually explicit images of women in her shipyard workplace. The ensuing in-class hostilities did not concern students' fears of getting a job, but rather focused on who should be involved in deciding worksite conditions - who *controls* personal expressions in "men's" workplaces. A few PES senior men with openly hostile, anti-woman (or alternatively pro-male) sentiments controlled the ISD classroom on the day of the Sexual Harassment class.

Where were challenges to the vocal minority's anti-woman sentiments? I was sitting with three men on the Sludge Team (Martin, Nate, and Russell) who not only disavowed sexist practices of the sort that the vocal men were demonstrating, but also did not practice sexism. I knew that men students on the Mercury Team (Samuel and Shane) did not agree with the vocal

minority. In addition, there were six faculty present, five of whom I knew well enough to say categorically that they too would find these vocal men's claims sexist. Yet, to my amazement, these five men students (and likely many others in the room), as well as most of the faculty, seemed frozen in their chairs. Only one man professor and one woman student spoke against the vocal men students, but both were shouted down, which no one challenged. This suggests that men as engineers develop at least two kinds of masculinity linked to gender relations. The first (exemplified by the went-too-far Greeks, described by Marianne, and went-too-far Academic-Achievers, such as Pete and Carson) practicing on sexist relations and the second revolving around respectful relations with women. The Sexual Harassment Class illustrates how higher-statused men student engineers (those who practice sexist relations) use their on-campus power to silence their more-progressive men student-engineer colleagues. In other words, when push came to shove at PES, the power of (some) men to define and control the situation in a way favorable to them went unchallenged. It appeared that men who did not share anti-woman sentiments learned to sit quietly and say nothing, as if to do so would challenge the power of those men expressing the hegemonic masculinity and risk being considered not-masculine and not-engineer, someone outside the culturally-dominant identities. Women found that arguing against sexist men had little effect besides making themselves and other women the targets for more harassment. Women know they must go it alone in this system. In fact, women find that their complaints are taken for "proof" that women do not belong in engineering.

This is how a pervasively anti-woman system can exist in spite of the fact that the majority of men studying and practicing engineering hold progressive ideas about women's place in engineering. Though my evidence is a bit thin since I cannot discern the cultural identities of the men in the vocal minority, what I saw in the Sexual Harassment class, combined with my observations of Pete and Carson, as well as with Marianne's experiences in her economics class, suggest that men espousing anti-woman sentiments find that they can get away with speaking against women publicly. Since several students and professors (women and men) referred to the presence of other PES climates hostile to women (and outside my purview) by saying "like what happened during the Sexual Harassment Class," I believe that the Sexual Harassment class is all-too-typical an example of the hostilities women face.

These situations are supported by PES engineering education structures and demonstrate how power is exercised at PES. Some high-status people on campus, those with the most prestigious identities, participate in virulent sexism. Their high status protects them from attacks. Student engineers with lower-status identities are more vulnerable. Though many noticed sexism in face-to-face interactions at PES, few challenged the sexist practitioners in public settings or on teams. The behaviors of these student engineers - both the overt sexism propagated by the vocal minority, Pete, and Carson, and the silence of women and men like Jessica, Martin, Nate, and

Samuel - were supported by the entire system.

Women student engineers also talked about how they "had to put up with" extra burdens imposed on them by engineering education[5] - burdens of "sexism," "stereotypes of women in engineering," "proving [men's misguided notions about women in engineering] wrong," and "dealing with guys that think women shouldn't be here." Men spoke in the same terms about women's need to ignore "being kidded about getting extra girl points [on school work]," "putting up with different attitudes and stereotypes about women in engineering," "guys rippin' on girls," and "[girls] being made fun of." Here, student engineers are describing an environment that is hostile to women, one of two forms of unlawful sexual harassment, but never acknowledging it as such.

Gender Neutrality - The Myth of Equality

Why are women expected to carry extra burdens and to conform to potentially noxious behaviors? How do members of the engineering community at PES explain such obviously unfair practices?

When I talked to student engineers and professors about equality, especially asking what it might mean to say that men and women were treated equally, they cited three key indicators of the lack of bias at PES: equal opportunities to learn, equal treatment by professors, and equal grading practices. Throughout each of these kinds of evidence, being treated equally was described as being treated "the same," and "the same as what?" took for granted being the same as men. Thus, the cultural meaning of "equality" had a hollow ring to it. "Equality" had shrunk to encompass only that small part of the campus terrain and substantial inequalities existed that were ignored. This measure of fairness is a curious notion that leaves peer groups, extracurricular activities, the curriculum, other teaching practices (besides availability and grading), curricular structures, personal interactions, and their masculinist underpinnings outside "equality's" purview.

It is a very strange sort of equality indeed that has women student engineers expected to conform to a campus culture that makes women invisible, while men student engineers find a campus culture organized to meet their needs. Misconstruing this extremely unfair set of practices as "equality" *demonstrates* community membership, signals one's sense of belonging in the engineering community. This is precisely the kind of fallacious "equality," masquerading as gender neutrality, that Katherine MacKinnon criticized (1989, p. 224):

> [Sex equality law based on gender neutrality] cannot recognize that every quality that distinguishes men from women is already affirmatively compensated in society's organization and values, so that it implicitly defines the standards it neutrally applies. Men's physiology defines most sports, their health needs largely define insurance coverage, their socially

[5] I provide these quotes without attribution to protect the identities of the respondents from their teammates. All of these quotes came from the freshman and senior students who were on teams that I followed closely.

> designed biographies define workplace expectations and successful career patterns, their perspectives and concerns define quality in scholarship, their experiences and obsessions define merit....These are the standards that are presented as gender neutral....(p. 224)

Will Kymlicka (1990) echoed and amplified MacKinnon's writings to clarify that "the principles which were developed with men's experiences and interests in mind are *incapable of adequately recognizing women's needs, or incorporating women's experiences*" (1990, p. 238, emphasis added). For Kymlicka, the problem is women's domination in U.S. society, that is, women's lower gender status. He argued that "the solution is not only the absence of discrimination, but the presence of power" (p. 245).

As we show in Eisenhart, et al. (in press), gender neutrality works to constrain women's participation and advancement in science and engineering, even when activities and identities motivate women to learn and they do well:

> [G]ender neutrality is double-edged for women. On the one hand, many women were attracted to the sites we studied because they were viewed as gender-neutral. On the other hand, an expressed commitment to gender neutrality by women, men, or the organization itself could hide the fact that work place norms privilege prototypically male behavior. Whether they recognized it explicitly or not, women are more vulnerable to assumptions of gender neutrality than men. For example, when gender differences are defined as irrelevant, there is a danger that no one will look to see how women are doing compared to men, no one will ask what women are particularly enthused or frustrated about, and no one will notice what women fear. (Ch. 12, p. 23)

This describes precisely the circumstances at PES. Acting in ways congruent with gender neutrality, PES professors and students participated in a cultural meaning system that guaranteed women's invisibility. In an ideal society, gender would not matter. Unfortunately, the PES engineering education community is far from ideal and gender matters a great deal.

Enacting themselves as members of the PES engineering education community, women's (and men's) seeing women's treatment *as equal* to that given men demonstrated women's determination to be considered engineers and members of the community, without appreciating the extent to which women's membership was marked by women's invisibility. Learning not to notice both men's privilege and women's invisibility became a condition of membership in the PES engineering education community. Thus, for women, "belonging" in the PES engineering community entailed women *not* belonging.

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